THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 26. Thursday, August 31st, 1922. No. 315

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
BESSEMER HOUSE, 5, DUKE STREET, ADELPHI
LONDON, W.C.2.

Contents.

	PAGE
Russian Metallurgy and Semi-Steel	173
Foundry Queries	174
French Foundrymen's Autumn Conference	174
A Modern Installation of Drying Ovens	175
Blast Volume	177
A Quick Breakdown Repair Job	177
Costing for a Small Foundry	178
An Apprenticeship Course in Foundry Practice—VII.	179
Contracts Open	182
A New Puddling Process	182
Small Runners and Sound Castings	183
Plaster Patterns	184
Eliminating the Gas Regenerator Chambers in the Open-Hearth Process	187
The Institute of Metals	187
Trade Talk	188
Company News	188
Iron and Steel Markets	189
Personal	190
Deaths	190

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institution of British Foundrymen.

PRESIDENT, 1922-1923, Mr. H. L. Reason, M.I.Mech.E., Holloway Head, Birmingham.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.
Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.
Birmingham: D. Wilkinson, 1,114, Bristol Road, Northfield, Birmingham.
Sheffield and District: W. A. Macdonald, 62, Bannerdale Road, Sheffield.
Scottish: W. H. Bound, 69, Minard Road, Shawlands, Glasgow.
London: V. C. Faulkner, 21, Stanley Gardens, W.11.
Newcastle-on-Tyne: H. A. J. Rang, 2, St. Nicholas Buildings, Newcastle-on-Tyne.
East Midlands: H. Bunting, 17, Marcus Street, Derby.
Coventry: J. M. Meston, 37, Melville Road.
West Ridings of Yorkshire Branch: A. Love, 232, Gladstone Street, Bradford.

Welsh Engineers' and Founders' Association.
Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

Russian Metallurgy and Semi-Steel.

Technical and scientific work has been pursued in Russia throughout the Revolution, but the results obtained are slow in arriving in Western Europe. M. Léon Dlougatch, however, has given an account in the July number of *Revue de Metallurgie* of the first congress of Russian metallurgists held since the beginning of the war. It took place at Moscow in November, 1920, when 220 professors, engineers and metallurgists had presented to them 69 papers, of which no less than 66 were of a scientific character.

In order to visualise the situation, the Chairman, Mons. S. N. Vankoff, gave statistics showing the relative metallurgical productions of the various manufacturing countries, and especially dealt with the United States, and in conclusion, stated that the natural resources of Russia were not less important than the States, and were certainly superior to any European country. Russia possessed everything necessary to develop its metallurgical industries, quite independently of other countries. The failure at the moment was due to lack of education and organisation. The war and the revolution had reduced all metallurgical operation practically to vanishing point.

Naturally the first subjects to be studied were the winning of raw materials and their transport, taking into the consideration the state of the country and its means of communication.

The programme was divided into two sections, theoretical and practical. The former admitted of seven subsections, having the following captions:—(1) Metallurgical raw materials, (2) special regional problems, (3) railways and transport in relation to metallurgical industries, (4) economical aspects with special reference to the standardisation of both raw and manufactured metallurgical material, (5) metallurgical resources of Russia, (6) the relation of metallurgy to modern industry, (7) technical societies.

The practical session was devoted to such subjects as the lack of raw materials and the steps to be taken to overcome it; the re-birth of Russian metallurgical industries; essential means of communication to effect this; mines and geology from the metallurgical aspect; technical schools to be placed on a new base to meet the current needs of the country. These questions were thoroughly discussed, and it was decided that peat-coke must be extensively used both in blast furnace and cupola practice, as the Donetz coalfield could not be relied upon to produce coke for a considerable period. The five following resotions were passed:—(1) The maximum amount of turnings, as they rapidly deteriorate *must* be used wherever possible. (2) Trials must be made for using turnings in the coke-fired blast-furnaces, as they have already been a success in the charcoal-fired ones. (3) A works at Moscow must be specially laid out for the baling of turnings, in order that they can be used in Siemens' furnaces. (4) New steel and cast-iron turnings must preferably be used in cupolas, and their needs satisfied. then open-hearth furnaces and blast-furnaces. (5) Briquetting works must be installed in the various metallurgical centres, in order that turnings may be most economically worked up.

Aluminium and nickel were considered to be of such importance that the Congress decided that not only surveys should be undertaken, but a nickel smelting works should be put down in the Urals.

After setting out definitely the most urgent lines of communication to be constructed, the Congress then laid down the basic principles to be followed in the building up of their metallurgical industries, and amongst these are found the following:—(1) The utilisation of very rich iron ores in order to reduce to a minimum the amount of fuel necessary. (2) The use of turnings and mill scale wherever possible. (3) The reduction to a minimum of the pig-iron used in the open-hearth furnaces. (4) The extensive utilisation of peat in gas producers. (5) The use of powdered fuel. (6) Semi-steel to be used as much as possible, as this introduces a dual economy by reducing the consumption of both steel and foundry pig-iron.

Semi-steel has evidently been studied considerably in Russia, especially by Professors Botchvar and Kaliumkoff. According to these workers, the best type of semi-steel is that possessing a structure consisting only of graphite and pearlite. The heating of semi-steel to within the range of 100 to 600 degs. C., followed by slow cooling, is practically without effect on either its texture or mechanical properties. Heated, however, to 800 deg. C., and rapidly cooled, semi-steel takes the quench, and shows a texture consisting of martinsite and graphite. Additionally its Brinell hardness is doubled. Semi-steel is easiest to treat thermally when its composition approximates the following:—Total carbon 3.0 per cent: graphite carbino,

2.2 per cent.; manganese, 0.85 per cent.; silicon, 1.1 per cent., whilst the sum of the Si. and Mn. here is given as 1.95, it can be as low as 1.75 per cent. As stated the texture must be pearlite and graphite only. Tempering between the temperatures of 100 and 400 deg. C. can vary the properties of semi-steel considerably, but from 500 to 600 deg. C. greater improvements are shown. Transverse strength is increased some 21 per cent., Brinell ball hardness decreased by some 50 per cent. when compared with quenched semi-steel, and increased 10 per cent. in comparison with the untreated material. Resistance to shock is increased from 10 to 12 per cent. It is preferable to quench semi-steel in oil, though water can be used. The authors point out that by controlling the constitution of semi-steel and its thermal treatment, it is possible to obtain castings of an exceptional quality.

Foundry Queries.

A Lead Casting Proposition.

Could you give me any information how to get a good lead or soft metal casting run on to a plaster cast. I have tried several methods but without success. I want a plaster of Paris cast for moulding a ten-inch disc, ¼ in. thick, with a few recessed places and the rest requires to be perfectly level, with a good face. I should be very glad if you could give me any suggestion, as I cannot get the metal to lie on the plaster cast; it boils until set and leaves great holes on the face.

" R. U."

The trouble of making plaster of Paris moulds is that they must be perfectly free from moisture before they can be used for casting lead or any other metal on to them. Since aluminium, brass, bronze and iron, and even silver can be successfully cast in plaster of Paris moulds, there should be no trouble experienced with the lower melting point metal like lead or some of its alloys with tin or antimony. If a pattern metal is wanted which will expand slightly in the mould, then 75 per cent. of lead, with 17 per cent. antimony and 8 per cent. of bismuth will be found useful, cheaper mixtures can be used without the bismuth. In every case, however, the drying of the mould must be perfect, otherwise steam will be given off and the casting will be full of blow holes.

In the first place when making the cast, the plaster of Paris is best mixed with warm water at about 170 deg. Fahr. (75 deg. C.), and as it would be too dense, and not porous enough if used alone, it is advisable to mix it while still dry with about an equal quantity of fine red-brick dust. To prevent the cast from sticking to the pattern or from adhering at the parting, oil or vaseline should be used to effect the separation.

When the plaster is thoroughly set, the drying operation may begin and this takes considerable time, as it must first be dried at a low temperature, such as a warm atmosphere, but not in a hot oven. The last traces of moisture are only removed by heating the mould to redness, preferably in a muffle, until the cast is equally hot throughout. As the mould will be soft and friable after this treatment, it is advisable to strengthen it with wires or nails similarly to an intricate core.

Before casting the lead into the mould, the latter should be embedded in sand to hold it together. It is sometimes claimed that by using some oily substance, such as lard, with which to soak the mould, that any slight amount of moisture left in the plaster will be prevented from blowing, but it is generally of the greatest importance to ensure that all the moisture is expelled from the plaster, as otherwise the hot metal will either scatter, or refuse to lie on the plaster surface and cause the holes which have evidently been the cause of the trouble.

T. J. P.

Aluminium Castings.

We have lately been casting some aluminium, the patterns are perfect, but the castings do not come out as clean as we would like. We should be very glad if you could give us any information on this subject, or do you issue a text book on aluminium castings?

Argil.

Very seldom is pure aluminium made into successful castings, and it is generally some alloy of this metal with either copper or zinc which is used commercially, and these alloys should always be referred to by their composition and not by a " number " which may lead to confusion.

In the first place the melting of the alloy should be carefully conducted as unsoundness frequently arises from too prolonged a time in the furnace irrespective of temperature, and too high a temperature even for a short time is equally harmful. Too high a temperature of pouring is perhaps the most fruitful source of defective castings, whether from the view point of pin-holes, or defective surface. For anything but the very smallest castings, the metal should be poured at the lowest possible temperature consistent with free running, say about 1,250 deg. Fahr. (625 deg. C.), and if the crucible is withdrawn from the furnace at a higher temperature as judged by a pyrometer, then the metal should be allowed to stand until it has reached this before attempting to cast.

The next most important consideration is the type of sand used, which must not be too fine, as this would prevent it from being free venting, nor too coarse, which produces a bad effect on the surface finish of the castings. A good sand suitable for high-class brass or bronze work should be quite suitable for aluminium alloys, and no attempt should be made to use artificial facing, as it usually acts as a trouble producer.

New sand with just sufficient clay naturally present to give it a satisfactory bond is the best for facing the mould, and if this sand shows any tendency to adhere to the pattern or at the parting, then both these can be lightly dusted with fine talc or French chalk. Facings with any organic matter in them are specially harmful, as this, by burning in contact with the molten metal, causes the latter to boil or bubble and make holes.

Too hard ramming of the sand close to the pattern can also prevent the metal from lying on the tight spot, and of course the mould should be thoroughly cleaned of any loose particles before it is closed, as aluminium or its alloys are so light that they can enclose loose sand particles just as easily as float them up the riser.

We do not know of any satisfactory text book on the subject of aluminium casting, but the United States Bureau of Mines has issued very valuable instructions to aluminium founders from the research work done for them by Mr. R. J. Anderson, whose papers have been published in this country, and the recent meeting of the American Foundrymen's Association devoted a whole session to the discussion of aluminium foundry problems which are now being reported in the technical journals here.

T. J. P.

French Foundrymen's Autumn Conference.

The Annual Conference this year is to be held at Nancy, on October 5, 6 and 7. The following Papers will be read and discussed:—

(1) A Further Study of the Metallurgy of Malleable Cast-Iron, by Marcel Remy (being a continuation of the Paper he submitted to the Liège Conference in 1921).

(2) Some Factors influencing the Quality and Strength of Cast-Iron during Melting in the Cupola, by Christian Kluytmans.

(3) (*a*) Note on the Inspection of Foundry Pig-Iron; (*b*) A Thermal Study of Cupola Practice, by Mons Seigle.

(4) The Influence of Phosphorus on Brass, by A. Portevin.

(5) A Practical Study of the Working of Side-blown Convertors, by Mons. Levoz.

(6) The Electric-Furnace in the Brass Foundry, by Mons. Brasseur.

(7) "Alpax"—a new light high-tension Alloy, and its Uses, by Mons. de Fleury.

Other Papers will be given by the Belgian and American foundrymen's associations. Amongst the works to be visited in the Nancy district is the foundry of the Etablissements Delattre and Frouard at Frouard.

Additional information can be obtained by applying to Mons. J. Carles, Association Technique de Fonderie, 10 rue de Lancry, Paris. x.

A Modern Installation of Drying Ovens.

The drying stove or oven is one of the important auxiliaries of foundry equipment which until comparatively recently has certainly not received the investigation and attention which it deserves. This is no doubt due, in the main, to the fact that it has been the exception rather than the rule to keep separate records of fuel costs for the stoves, and if the performance of the ovens was reasonably satisfactory in tonnage output, their working costs did not come into question.

The more exacting requirements in engineering practice of to-day, however, demand a very much higher efficiency in drying, if castings losses are to be kept within commercial limits, and in his search for an oven which will give him a uniformity of production, the foundry manager has not unnaturally given due consideration to the costs attendant upon the attainment of such uniformity.

Some twenty years ago Mr. H. M. Lane, the well-known American expert on foundry practice, was called upon in his capacity of consulting foundry and metallurgical engineer to solve a good many foundry problems, troubles which the foundrymen were blaming on to the metal, but

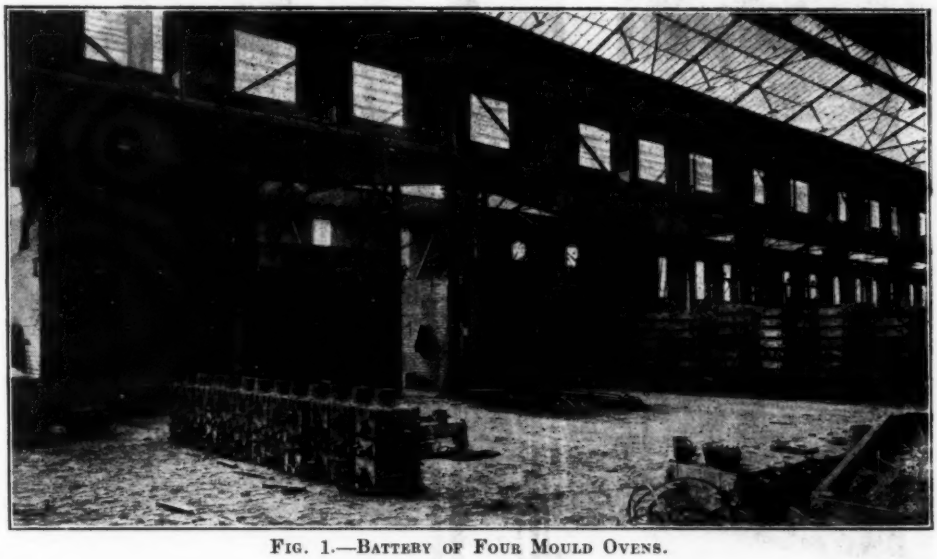


FIG. 1.—BATTERY OF FOUR MOULD OVENS.

which in a number of cases were conclusively proved to be due either to the moulding sand or the cores, and with the advent of the automobile cylinder with its extensive thin water-jacket cores it became necessary to make a core of maximum strength and minimum gas content. The castings loss with the old-style ovens rose to alarming proportions, and many experiments were made with a view to evolve a design of oven which could produce a uniform drying heat and turn out more satisfactory cores. Gas-fired, oil-fired, solid-fuel-fired, and even electrically-heated ovens were experimented with. The oil binder was, of course, the best for certain classes of cores, and where such a binder was employed it was not merely a straight drying problem but a chemical reaction which was involved, and it was necessary to sweep a large volume of air through the oven and oxidise the oil. Forced-draft ovens were tried, but the forced draft increased the temperature of the incoming gases, and resulted in irregular temperatures in different parts of the oven, burning a good many of the cores. It was then that Mr. Lane took out his first patent, which provided for the introduction of auxiliary air into the products of combustion after they had been formed, so as to dilute such products, reduce their temperature, and furnish a larger volume at a lower temperature which could be safely applied to the drying of cores. Under this patent many ovens were built involving all classes of fuel.

An oven with a large number of holes in the walls for the introduction of pyrometer thermo-couples was fitted and another set of tests run. It had been found in practice that a little back of the centre of the oven, on the floor, was a point where the cores did not dry properly. In the old-style oven it had been proved that at least 80 per cent. of the gases in the oven were re-circulated. With the forced-draft oven this had been greatly reduced, and the moisture eliminated more quickly, but with the solid-fuel-type oven and the outlets near to or flush with the floor, there was always a blanket of moist or relatively cold air near the floor which carried a large percentage of moisture, and did not permit the rapid drying of the cores in this part of the oven. To get the moisture out of the oven without re-circulating, and to effect drying clear to the bottom, Mr. Lane constructed a hollow chamber beneath the floor, into which the products of combustion or moisture could descend and from which they could be exhausted. This arrangement, which is covered by patent rights, had a revolutionary effect on the performance of the oven and resulted in castings loss being reduced to a minimum.

As the outcome of the experience gained in his lengthy experiment, Mr. Lane decided there were three cardinal points essential to the efficient and economical working of a drying oven:—(1) Introducing into the oven a large volume of gases at a relatively low temperature when compared with the temperature of combustion in a forced-draft firebox. (2) The sweeping of these products of combustion through and around the cores or moulds in such a way as to effect a heat exchange between the incoming products of combustion and the material in the oven. This heat exchange naturally results in the extraction of moisture, and such extraction rapidly cools the gases, carrying them with the moisture content to the bottom. (3) To trap the moist air in such a way that it cannot recirculate, and to get it out of the oven as quickly as possible.

The Lane patent forced-draft auxiliary-air core oven has been designed to meet the above-mentioned requirements, and on a recent visit to a large foundry in Sheffield our representative had an opportunity of seeing an installation of ovens built and erected by Messrs. August's Muffle Furnaces, Ltd., Halifax, who have acquired the sole selling and manufacturing rights of "Lane's Patent System" in Great Britain. The installation under notice consists of a battery of four mould ovens each 12 ft. × 24 ft. × 10 ft. The method of travelling the carriage in and out of the stoves is novel and simple. The carriage consists merely of a substantial girder frame, the bottom members of which are placed longitudinally in tandem with the oven floor; two parallel grooves are provided in the oven floor and are extended

for a distance into the shop; these grooves are charged with cast-iron balls, and it is upon these balls the carriage is travelled by means of a jib. The stoves are placed two on either side of the firebox, which is situated in a special pit below ground level. Air is supplied at about 3-in. w.g. by a small fan driven by a 6-h.p. motor; no additional pull is obtained from the steel chimneys, which are merely sufficient to take the spent gases clear of the building. A full charge for one of the ovens is 90 boxes, the total weight of the charge, including boxes, being approximately 40 tons. The time for drying is about eight hours, with a temperature of 250/280 deg. C.

It is not possible to give fuel consumptions which are fair to the ovens, as they have not yet been worked to their full capacity. Starting from cold, however, on three ovens charged with 120 tons of metal and sand at 4 o'clock P.M., and drawing the ovens at 7 o'clock A.M. next day, the total consumption of best coke was 30 cwts., though obviously the second charge would have been got out with not much more than half that consumption. Best coke only is used, as experience has shown this to be most economical.

The core shop is provided with a battery of seven ovens of the chamber type and one of the drawer type. Of the first-named two are 6 ft. × 8 ft. deep × 6 ft. 6 in. high, and five 6 ft. × 4 ft. deep × 6 ft. 6 in. high. All these ovens are heated from a central firebox with blast supplied by a fan similar to that of the mould ovens.

In connection with the core ovens Messrs. August's muffle furnaces are responsible for two useful innovations, one being the portable rack which is run along a line of track from the core bench to the oven. In the foundry seen by our representative a large number of these racks are in use as storage racks; this affords a very convenient method of carrying the cores, and at the same time reduces the necessity of handling. The second innovation is the mechanical contrivance for withdrawing and supporting the drawers of the drawer-type oven.

The arrangement and system of heating may be briefly described as follows:—The air from the fan is driven into the pit and warmed, just sufficient air being allowed to pass through the bed of the fire to maintain a red glow—a temperature far below that of producer gas. By a series of flues, large quantities of air are heated, further air being allowed to pass over the fuel. A special chamber provides for the auxiliary air and also serves as a mixing chamber for the air and gas. The heated air and products of combustion from the firebox are drawn into a large flue which acts as a reservoir from which heat can be tapped as and when or where required.

Regulating dampers are fixed at the back end of the chambers from which the heat travels in the direction of the chamber doors. At the front of each chamber perforated plates and dampers are attached to a series of flues, the arrangement of which provides such control over the heated air that an absolute uniformity of temperature is obtained throughout the whole of the drying chamber. The air ultimately passes into a common outlet flue and thence to the stack, which, as already stated, serves no other purpose than to conduct off the fumes.

We may now consider some of the particular and peculiar features of the system. It will at once be evident there is complete control over the rate of combustion, the independence of the chambers to each other tending to reduce fuel consumption to a minimum. The independent arrangement of the chambers also permits of a battery of ovens being worked at varying temperatures by a simple regulation of the dampers.

The advantage to be derived by extracting moisture from a core or mould with uniformity, and equal application of heat for baking, will be too generally appreciated to need comment. If heat alone were the drying medium, it would be impossible to get the whole of the moisture away from the core or mould without condensation taking place in the chambers, and it would also be practically impossible to dry a core or mould absolutely uniformly. In whatever direction the heat was travelling the surfaces of the sand structure facing in that direction would be dried first. In the drying of oil sand cores a liberal supply of oxygen is essential, a condition which is fully satisfied in the system under notice.

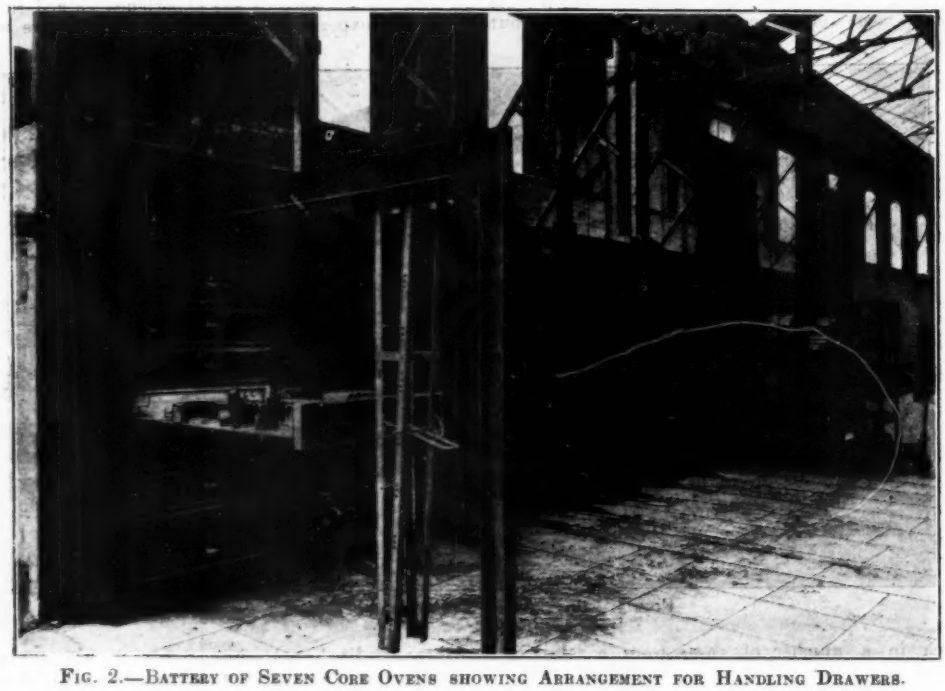


FIG. 2.—BATTERY OF SEVEN CORE OVENS SHOWING ARRANGEMENT FOR HANDLING DRAWERS.

German Railway Rates.—As a result of the depreciation of the mark, the German Railway Administration has decided to increase the present goods tariff by 50 per cent. as from September 1, but the more recent slump may entail a greater increase.

Sociedad Anónima Franco Belga de las Minas de Somorrostro.—This concern reports for 1921 that the coal strike in Great Britain greatly affected the Company's business. Their sole customer while the crisis in the British pig-iron industry lasted was the Sociedad de Altos Hornos de Bilbao. The sales in 1921 were:—First quality ore, 58,262 tons; washed ore, 20,260 tons; roasted ore, 28,880 tons; total sales, 107,402 tons. The amount available for distribution is 413,768 fcs., which allows for the payment of a dividend at the rate of 7 per cent. (35 fcs. per share).

Blast Volume.

By P. A. Russell, B.Sc.

The importance of the volume of air that is delivered into the cupola is repeatedly being emphasised by all experts on cupola practice, but the difficulty that confronts most ordinary foundrymen is the installation of some instrument with which to measure this volume. There are several good instruments on the market, but their cost prohibits them in the smallest foundries.

This problem becomes much more important where the blast is supplied by a fan. A positive blower will, within limits, deliver a constant amount of air when driven at a constant speed, but the air delivered by a fan varies greatly according to the resistance which the stream of air meets with upon its course. This difference is very great in irregular cupola working, and practically the only means of detecting it is by means of some instrument to measure the quantity of air delivered.

The simplest form of volume meter consists of the Pitot tube, by which the speed of the air in the blast main is measured in ft. per second, which, when multiplied by the area of the main, gives the volume supplied in cubic ft. per second.

The author has installed a home-made apparatus of this type, from which he has been able to obtain some very useful information about the working of the cupola to which it is attached.

The materials required were 3 ft. of brass tubing, a few feet of rubber tubing, and 2 ft. of glass tubing, add 5/32 in. internal dia. A sketch of the apparatus is shown in Fig. I.

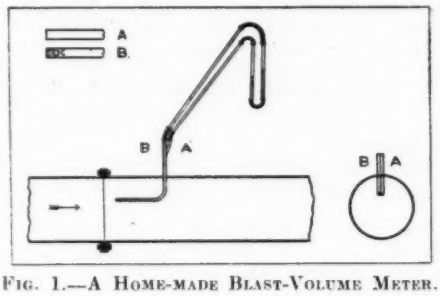


FIG. 1.—A HOME-MADE BLAST-VOLUME METER.

The tubing was sawn into two lengths of 18 in., and one end of one piece stopped with a brass plug, and 8 small ⅛-in. holes drilled into the side of the tube just below the plug. Each tube was then bent through a right-angle at the centre, and the two soldered together side by side. These were then introduced and soldered into the blast pipe, so that the ends of the tube were one-third of the way into the pipe, and the tubes pointing square along the pipe. One-third across the pipe is taken as the position of average velocity of the stream of air. Two 1-ft. lengths of glass tubing were jointed together with a short length of rubber tubing, half filled with water, and fastened into a board in a convenient position for reading the level of the water. The open ends of the tubes were connected to the open ends of the brass tubes by rubber tubing.

How it Works.

The effect, when air is passing along the blast main, is this:—The pressure of air that tries to escape through the tube B is solely due to the pressure of the air in the main, but in the tube A this is supplemented by an amount due to the speed of the air travelling along the main, and attempting to pass up the tube. Thus, as the two tubes are connected one to each side of the water gauge, the pressure on the side of the tube A will be equal to the pressure in the main plus the pressure due to the velocity of the air and on the side of B, the pressure in the main alone. Thus, the water in the gauge will show the pressure due to the velocity only. Therefore, by reading the height of the water in the tubes it is possible to obtain a measure of the velocity at which the air is being delivered into the cupola, and consequently the quantity of air delivered per minute.

For observations on the comparative working of a cupola under different conditions the measurement of this difference in level is sufficient. Thus, if the fan can be run at various speeds, a series of observations can be made to determine what blast velocity (or quantity) gives the best results.

Results Obtained.

It was found that, with a fan running at constant speed, the delivery of air varied considerably throughout the blow. Several factors enter into this, the main ones being the amount of charge in the furnace, the size of coke, etc., and the state of the tuyeres. It was most noticeable when the tuyeres became partially blocked by chilled slag forming in front of them, that the delivery of air fell greatly, and a careful use of the bar rectified this at once. The effect of the hanging of the furnace was also noticeable on the water gauge. Thus, by a little observation, any irregularity in the working of the furnace can be easily detected.

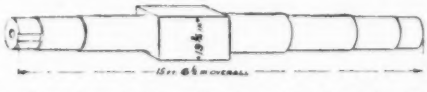
An ordinary pressure gauge gives practically no indication of any of these irregularities, only showing a slight drop in pressure as the furnace is blowing down, whereas at the same time the Pitot tube indicates a great increase in the quantity of air delivered.

But if it is desired to obtain absolute figures of the quantity of air delivered, the problem becomes more complex. The formula usually given for the Pitot tube is:—Velocity in ft. per sec. = 58.9 × head of water in inches, but the author has, so far, been unable to check whether this is true for the particular type described, though it appears to apply, or very nearly so. Also corrections, though slight, need to be made for the temperature of the air.

This, however, is not necessary for ordinary routine work, and if the height of water which corresponds to the best working of the furnace is determined, and steps are taken to see that this is maintained throughout the blow, a great increase in the economy of the furnace and regularity of the product can be obtained.

A Quick Breakdown Repair Job.

A smart bit of engineering repair work has just been carried out by Messrs. Walter Somers, Ltd., of Halesowen, in connection with a breakdown at the Newport Works of Messrs. John Lysaght, Ltd. A new forged steel shaft was required, and the order for it was received by Messrs. Somers on the afternoon of Wednesday, August 2. The shaft, which we illustrate herewith, required to be forged, heat-treated, finish-turned to gauges on diameters, the square middle portion to be planed to gauge, keyways cut in each end, and a



4-in. hole bored through the entire length of the shaft. As it was a breakdown job, Messrs. Lysaght gave instructions for the work to be carried on continuously until the shaft was completed. By so doing, Messrs. Walter Somers, Ltd., were able to get the shaft finished and loaded on to a truck by mid-day on Tuesday, Aug. 8, and despatch it to Newport. The Great Western Railway arranged for the shaft to be delivered next day at Newport, and Messrs. Lysaght immediately got to work, and keyed on a large gear wheel to the central portion, fitted two eccentrics, put on the crank webs at either end, and were able to get the mill running again on Monday, August 14.

Sociedad Minera y Metalúrgica de Peñarroya.—This Franco-Spanish concern is distributing for 1921 a dividend at the rate of 9 per cent., as against 17 per cent. in 1920. The report states that the situation at the collieries has not improved. The competition of British coals has been very great, especially during the second half of 1921, and the import tax of 3.50 to 7.50 fcs. was not sufficient to keep the foreign coal out of the country, especially in the coastal regions and their immediate neighbourhood. The Company's coal output has fallen off from 563,191 tons in 1920 to 513,271 in 1921.

Costing for a Small Foundry.

By F. A.

The object of this article is to describe the methods adopted by the writer to obtain fairly accurate costs for the castings produced in his foundry. The total probable requirements were not expected to exceed 7,000 lbs., made up of the following details:—

Material.	No. of Castings.	Weight in lbs.
Iron	272 ...	3,025
Aluminium	960 ...	3,285
Phosphor bronze	288 ...	537
Brass	160 ...	48
	1,680 ...	6,895

Actually, the requirements never exceeded two-thirds of the above. The total floor space available was approximately 3,000 sq. ft., which included cupola stage, this being on same level as the upper portion of building, where non-ferrous castings were produced.

Owing to constant changes in design, it was not advisable to mount patterns on plates, the method adopted, chiefly with the smaller castings, being to work from plaster match plates, as being easily replaced at small expense on the frequent occasions when change in design rendered them obsolete. The heaviest castings were, roughly:—Iron 70, aluminium 45, bronze 5 lbs., and brass 6 ozs.

The only labour available was local, and in no single instance had there been any previous foundry experience. Considering that practically all the castings required a fair amount of machining, being for motor-car manufacture, it will be agreed that the task was no light one. However, with the exception of the cylinders (four-bore type), excellent results were obtained, the difficulty with these being due to the irregularity of the quality of the cores, which made it necessary to allow a large margin to ensure that the machine shop was not disappointed. Seeing that the cores, including the oilsand jackets of a rather delicate type, were made by girls with no previous experience, this was only to be expected. The average output of these cylinders was about 12 sound castings weekly.

The total number of employees was 20, which were allocated as follows:—Moulding 7, coremaking 6, iron and non-ferrous melting 1 each, labourers 2, dressers 3.

The only machinery was a direct motor-driven fan, a sand mill, and a pair of 15 in. × 2 in. grinding wheels, driven by another motor. All gates and runners were removed by hack-saw or hammer and chisel.

The numbers on the patterns were rather involved, and to avoid turning each workman into a clerk, each was known by a foundry job number, and in the case where several patterns of a different number were mounted on the one plate, a foundry job number was given to the whole box of patterns, which might contain 3 to 10 castings per box.

In this way job numbers 1 to 9, inclusive, related to iron; 10 to 26 to aluminium, and 37 to 40 to bronze and brass.

Each employee had a job card, on which, in space provided and according to the code below, he indicated the job on which he was engaged. Thus, A signified moulding, B core-making, C dressing castings, D melting, and E labouring.

Moulders required a separate card, which lasted the whole of the week, for each job number. In the case of coremakers and dressers, only the more important jobs were booked direct to the jobs on separate card, the others being grouped under a general heading, as B iron; or C aluminium, meaning respectively coremaking for iron castings, and dressing aluminium castings. The furnacemen would put D iron or D brass and aluminium, indicating that the time was due to melting iron and melting non-ferrous metals respectively.

Labouring by any person would be described as E iron, E aluminium, E bronze, according to section engaged upon.

In ascertaining the cost of any particular casting or group of castings, the form set out is used, the cost of the metal being brought down to a price per lb., which includes coke, furnace repair and materials; while the furnaceman's, labouring and casting wages are placed in their respective columns, D and E, at their price per pound.

Moulding, as previously stated, is always a direct charge, and placed under A. Coremaking may be either direct or indirect. If the latter, it is charged at a rate per pound under B. Dressing is treated similarly to coremaking, and placed under C. In calculating these indirect charges for the price per pound factor, the gross weight of all *indirect* product only is placed against the *indirect* labour cost.

The whole of the information regarding labour L and metal M being now obtained, the cost can be worked out from the formula:—
M + L + (% of L for S.E.) + I = gross cost, G.C., I being a percentage of L + S.E. as insurance premium against wasters.

In the example given, the casting is a cylinder, and I has been taken at 20 per cent. S.E. was taken at 100 per cent. of L, and included interest on capital outlay on plant and buildings, insurance, rent, rates and taxes, salaries, stores, repairs, power, haulage, small office expenses, and general stores.

Profit is generally reckoned as the difference between market prices and own costs when the foundry is supplying their own machine shop direct.

To verify any system of cost-keeping and prove its correctness, the value of the product should be taken over a period of one week, or longer, and compared with the total expenses incurred over the same period. They need not necessarily balance, as, if the insurance factor, I, has been used liberally and the foundry has been having a run of luck, there may be a balance to the good.

The satisfaction in knowing that one is making a profit is worth the time taken in getting out the necessary particulars.

Taken at a price per lb., the individual jobs or groups of jobs in some cases were abnormally low, and in other cases high, depending on proportion of labour and risk as compared with the weight. This shows the folly of some firms' methods in charging a uniform price per pound. Actually, the analysis of the costs showed that, with 17 castings comprising one set of iron castings, there were eight widely different prices per lb. The lowest was for fly-wheels, and the highest for exhaust pipes. Cylinders occupied an intermediate position. There was no hoist, with the exception of a small box hoist used solely for delivering the cores for the cylinders and other iron jobs from the coreshop on the first floor, so that the whole of the materials for the iron furnace, milled sand and materials for non-ferrous castings, and core materials for the coreshop had to be brought upstairs by hand.

The writer is certainly not recommending the establishment of any foundry using such obsolete methods, but the results obtained show what can be achieved by proper organisation, even with such limited means at one's disposal.

Form I showing a system of costing applicable for small old-fashioned foundries.

Prt No.	Job No.	Weight.	A.	B.	C.	D.	E.	Total L.	% L = S.E.	Allowance for Scrap.	G.C.	Cost per lb.
A 2—1	1	69 lbs. @ 1½d. 8/7½	5/6	4/–	2/–	69 lbs. @ ·3d. 1/8¾	69 lbs. @ ·3d. 1/8¾	14/11½	100 % of L =14/11½	20 % of L + S.E. 6/–	44/5½	7.73d.

An Apprenticeship Course in Foundry Practice.—VII.

By Ben Shaw and James Edgar.

MOULDING BOXES AND SECTIONS.

When it is recognised that moulds, apart from those which are made in open sand or loam, must be made in sections to obtain correct impressions from their patterns, the need for some form of equipment to carry the various parts will be obvious. Boxes or frames serve the purpose admirably, and, providing they possess the necessary facilities, they are a simple means of separating the mould in such a manner that the sections can be returned to their relative positions without damage to the mould. Apart from their value for lifting purposes, they serve to retain the sand within definite limits, a necessary condition because the mould is produced by ramming the sand about the pattern, a process which spreads the sand outwards, involving some support, such as moulding boxes give, so that the sand can be consolidated regularly. In addition, it must be remembered that metal, when molten, behaves similarly to other liquids, and it applies pressure to the sides of the mould. Thus moulding boxes not only support and protect the sand, during the process of ramming or the division of the mould into sections, but they assist the mould very considerably to withstand the pressure of the metal.

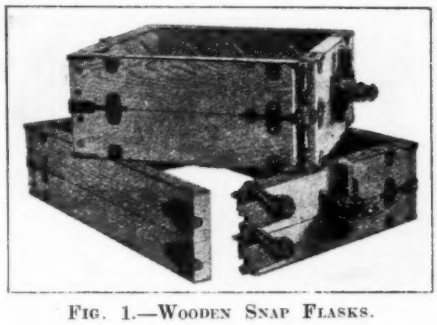


FIG. 1.—WOODEN SNAP FLASKS.

With the exception of open sand moulds, for which the foundry floor is generally used, and a French system, all green or dry sand moulds are prepared in boxes, or the foundry floor may be used for parts of the moulds, to a more or less extent, and the remainder carried in boxes. In loam work no ramming is necessary, and entirely different facilities are required to give the desired support to the mould and the means for lifting, the nature of which will be considered in a later article. Moulding boxes are divided into various parts for convenience in obtaining suitable impressions, pins and corresponding holes being generally used for locating the various parts to form the whole box.

Snap Flasks.

Although boxes must be used to support the sand while ramming, for separation and lifting purposes, they are not always essential during the time of casting. When a large number of small castings are required, snap flasks are frequently employed, particularly when the work in the foundry is of a repetition character, because they curtail the equipment of moulding boxes that would otherwise be necessary. Snap flasks are similar to ordinary moulding boxes, excepting that they are hinged in such a way that they can be removed from the moulds after the moulds have been finally located in their casting positions and before the metal is actually poured. In this way the same flasks or boxes can be used over again as quickly as they can be removed from their completed moulds. Not only is their use economical for certain classes of work, because they reduce the moulding box equipment of a foundry, but they relieve profitable space that would otherwise be occupied by stacks of boxes.

These flasks are usually constructed of wood, with cast malleable-iron fittings for locating the parts, reinforcing the corners, providing the metal hinge, and for the snap clasp at one corner which secures the section until the mould is completed. Although wood is in more general use, aluminium snap flasks are gradually being introduced. Fig. 1 shows the more common form of snap flask, and it will be observed that grooves are cut along the sides of the interior of each part, thus preventing the movement of the part mould in a vertical direction, when the parts are separated. Iron strips are attached to the top of the woodwork to protect it when scraping or strickling off surplus sand. As with other types of moulding boxes snap flasks are made in parts, but the number is limited to two in general practice, and, as no supporting bars can be carried inside to support the sand, their size is also limited.

The use of this form of box is almost invariably confined to machine moulding because they are only advantageously employed on repetition work. Although these flasks are removed from their moulds, some form of support may be necessary to assist the mould to withstand the pressure of the metal during the time of casting, or, even though the lateral pressure may be insignificant, some support is desirable for supporting weights applied to the top to prevent a lift. When the castings are very small, the weight of sand forming the mould is generally sufficient, but, when there is a doubt about its weight being enough, it is better to encase the mould with sheet iron. Special cases should be on hand to suit the inside shape of the flask in use.

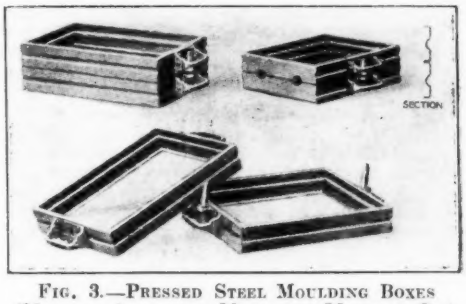


FIG. 3.—PRESSED STEEL MOULDING BOXES (MESSRS. ADAPTABLE MOULDING MACHINE CO.)

Ordinary Moulding Boxes.

The general type of moulding box consists of solid frames, varying in the number of parts and in the depths of each part, and, when there is a risk of the sand collapsing in any part, bars may be introduced to give the necessary support. These boxes are made in wood, aluminium, pressed steel and cast-iron, and they may vary in shape according to that of the work for which the boxes are to be used, for the very important reason that it facilitates the operations of the moulder.

Wooden Boxes.

Wooden moulding boxes are more frequently resorted to in jobbing foundries than in foundries producing standard or repetition work, because the wide range of work done demands a considerable variety of boxes, and, although metal boxes are preferred and are made when there is a likelihood of them being generally useful, or when a number of castings are required from the same pattern, yet wooden boxes are so quickly prepared, at little expense, that they are an economical proposition when they are required urgently, or when a similar type of box is rarely needed. A wooden box can, of course, be cut to suit a job much more readily than a cast-iron box, a factor of importance when slight modifications will render it suitable for other work. Although occasionally a full box is made in wood the use of this material is generally limited to the making of cover boxes. The major part of the moulds for which these are used are prepared in the foundry floor and a wooden cover box simply carries the top impression or cope.

They are lighter than iron boxes though not so strong, and they should be constructed to maintain rigidity when they are lifted. An illustration of a wooden cover box, often used for pipe work in jobbing foundries, is shown in Fig. 2. The sides, it will be noticed, are carried beyond the ends of the box to provide handles, and wood bars are introduced at intervals between the sides for additional support to the sand. It is better to leave the timber rough on the inside so that the sand will adhere more firmly. These boxes are, however, clumsy, and being more in the nature of makeshifts to expedite work, they should not be used for heavy or large castings.

Pressed Steel Moulding Boxes.

Mild steel moulding boxes are a more modern product and they are certainly an acquisition to the foundry, being light and almost unbreakable. The frame of each part consists of two pieces of rolled steel, having either a channel section only or grooves in addition, which gives rigidity to the box as well as support to the sand; these two pieces are jointed at the centre and welded, and the joint is strengthened by having the handle riveted over. Thus excepting for the lips, which are cut and welded, the corners are solid, which add considerably to their strength. Fig. 3 shows two forms of steel boxes, one suitable for horizontal casting, while the other can be used for vertical casting. The sectional shape of the steel is also shown. Any number of parts may be employed to suit the work.

Many different forms of these steel boxes are now obtainable, the sectional shape of the rolled steel varying and, in the larger forms, bars are introduced to specification, or they possess facilities for introducing loose bars as circumstances warrant. Mild steel moulding boxes have not displaced cast iron for large boxes, nor are they likely to, because of increased relative cost of production, but we believe that large flat cover boxes may ultimately be made in mild steel if only to reduce the weight of these boxes while still retaining the requisite strength. These boxes are used principally for machine moulding. Aluminium moulding boxes are not used to an appreciable extent, although they offer possibilities for small work because they are light and easily handled.

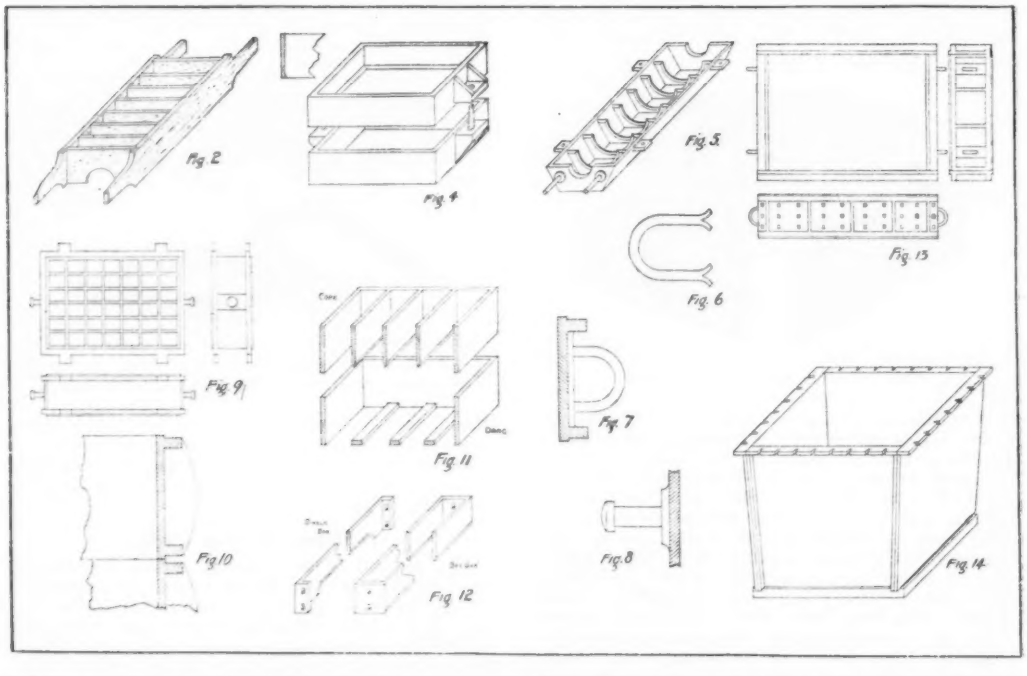
Aluminium Moulding Boxes.

A special adjustable moulding box of aluminium has recently been put on the market, its minimum size is 12 in. by 10 in., and its maximum 16 in. by 14 in., and it is readily adjustable to any size between these extreme dimensions. It is claimed that, where several sizes of boxes are used, the number stocked can be considerably reduced by using adjustable boxes. No doubt such boxes may be profitably used for small work prepared on machines providing that the rigidity at the varying sizes is not affected by continual use.

Cast-Iron Boxes.

With the exceptions mentioned above, the use of which is limited to a varying degree, moulding boxes are generally made in cast iron, and there is no limit to their use. Not only are cast-iron boxes used for small work, but also for the largest moulds made in green or dry sand, whether they are prepared on machines, at the bench, or at the foundry floor. They are strong and rigid, when suitably designed, and they are economically made. Apart from the smaller boxes, which are usually standardised and requisitioned from a manufacturer, moulding boxes are made to suit the work for which they are to be used, either by the foundry requiring them, if an iron foundry, or to specifications supplied to a local foundry. Many steel and brass foundries, however, have facilities for melting iron in order to make tackle, which may be necessary for the moulds being prepared, and sometimes they cast their own moulding boxes.

The designs of moulding boxes vary considerably not only to suit the kind of work and its size, but also to suit the equipment in the foundry, and frequently the particular views of the foreman moulder. A typical example of the ordinary cast-iron moulding box for machine or bench work is shown in Fig. 4. As the sizes increase it is necessary that the box be equipped with bars, and because of the additional weight of the box and sand which it carries, suitable facilities must be attached for lifting and turning over. When hand labour is involved, and either two or four men are essential to separate the parts and turn over the cope, handles should be cast into the boxes at convenient positions for lifting. An example of a two-handled box is illustrated in Fig. 5. It is a type commonly used for pipe work, and it is shaped off to reduce the ramming space. Box bars are necessary in this type of box, parallel with the ends only and about 6 in. apart, according to the width of the box. When the size demands the requirement of mechanical means for lifting, special snugs should be cast on the box or, preferably, wrought-iron staples cast in the box. These staples, to which cranes are slung, are of round material and large enough in diameter to take the weight of the lift with ample security. The ends should be splayed in the manner shown in Fig. 6, and the box side should be reinforced or thickened about the ends so that partial fusion may be effected. When there



is room it is better to cast the staples in vertically, as in Fig. 7, but in shallow boxes they must be set horizontally because of lack of space. With medium size boxes it is convenient to cast trunnions or journals at each end and in the centre, such as is shown in Fig. 8. These are invaluable for turning over box parts and save the work of the crane, besides reducing the possibility of damage to the mould through jolting. The boxes are either supported by standards so constructed that they form a bearing for the journals to enable them to be turned, or special chain slings may be attached to the crane which, when passed over the journals and the box lifted, form a bearance for the same purpose.

Invariably large moulding boxes are flanged externally not only to give additional strength but also to provide a means for clamping the box parts together in order to resist their possible separation, during the time of casting, by the pressure of the metal. Some moulders prefer the flanges plain, while others have equidistant slots cast in them to receive bolts, the choice of which is the better is largely a matter of opinion. A common form of solid cast moulding box for medium-sized work is shown in Fig. 9. It will be noted that the flanges are kept clear from the edge of the box parts in order that a close joint may be more likely to be effected. When it is not possible to use journals for turning the parts of the mould over, an operation which would, with large heavy moulds, probably be risky owing to the strain on the box being localised, curved flanges or rockers are frequently cast on the sides of boxes similar to that illustrated by the section in Fig. 10. These boxes are actually rolled over with the flanges resting upon the floor, when the moulds require to be turned. These are preferable to the straight flanges, because they roll over more regularly with less possibility of jolting.

Box Bars.

Reference has already been made to box bars for giving additional support to the sand, and though, in some cases, there is little difference between the bars introduced in both bottom and top box parts, as a rule they differ considerably. Generally, in a two-part box the majority of the mould is carried in the drag or bottom part, whereas as little as possible is carried in the cope or top part. There are, of course, many exceptions to this rule which will be considered when we deal with the jointing of moulds. To give the box a wider scope for usefulness the drag is frequently almost devoid of bars, and when they are cast in with the part they are invariably flat bars across the bottom, either between the two sides, as shown in Fig. 11, or between both sides and ends according to the area of the box. In the cope, however, vertical bars are used and, instead of being straight, as in Fig. 11, they may be shaped to suit the work for which the box is likely to be used, such as is shown in Fig. 5. The question obviously arises, why is it necessary to have deep bars in the cope when they are almost discarded in the drag? It must be remembered that it is the cope that is to be lifted and turned over, whereas though the drag may be moved for casting purposes, it is not often necessary to turn it over after the pattern has been withdrawn, thus the mould needs less support in the drag than in the cope. In middle parts, that is the term applied to any box part necessary between the drag and cope, the use of bars connecting sides or ends is rarely possible, but small bars may be cast on both sides and ends, their length depending upon the available space between the work to be moulded and the sides of the box part.

Wood Bars.

In many cases the boxes merely consist of frame and wood bars cut and wedged into position as desired or the boxes may have facilities for taking loose cast-iron bars. Both methods are very practical and have a wide usefulness, particularly in jobbing foundries, where it would be absurd to attempt to stock special boxes for every class likely to be done. Wood bars are usually employed with smaller boxes, but they are not sufficiently rigid for large boxes. Cast-iron bars can only be used satisfactorily when holes are cast through the sides of the moulding box, corresponding holes are cast through flanges on the bars so that they can be bolted in position.

Box Bars.

Either single or double bars—generally referred to as box bars—may be employed, as shown in Fig. 12, but usually box bars are stocked, whereas single bars are cast as required. Loose bars are very quickly produced to suit any work for which the frame box can be used, and the contour can be made to follow that of the work. It is important to remember that there should be at least ½ in. of sand between the edge of the bar and the face of the mould, against which the metal is to be cast, and the edge of the bar should be well chamfered on each side, as shown in Fig. 12, so that the sand under the bar is accessible for ramming to an equal density to that elsewhere. All bars which are to be bolted in position should be cast at least ¼-in. shorter than the inside width of the box, so that it can easily be located.

Sectional Boxes.

Solid boxes which are stocked in a foundry occupy much valuable space, and when there is little room for expansion, as much available space as it is possible to obtain should be made profitable when the occasion demands it. Sectional boxes do much to assist in using the available space more effectively. They are particularly suitable for large and medium-sized boxes. Sides and ends are made separately and bolted together when required. Separated sides and ends take up much less space than a solid cast box, and if the sides and ends are standardised for varying depths, boxes can be assembled according to requirements. It is desirable to keep a stock book showing the sizes of available sides and ends so that no time need be wasted in sorting out. This applies also to box bars, which must be loose for sectional boxes. The time taken in assembling a sectional box is frequently looked upon as a serious drawback, but that depends upon the organisation of the foundry, and, it must be confessed, that the same drawback can be applied to solid boxes, particularly when it is necessary to search the railway siding, the favourite dumping ground for moulding boxes. An illustration showing the formation of a sectional box is indicated in Fig. 13.

Cases or Pits.

In many foundries a considerable amount of work is done in the foundry floor. In some instances it is quite satisfactory to dig a hole and use the compressed sand of the floor as a support for ramming the sand of the mould which is to be made in the hole or pit, but, when work is large and dry-sand moulding is involved, it is better to sink a moulding box in the floor, and it is preferable that the bottom be of metal also, in order that the mould may be self-contained and not subject to influences over which the moulder has no control. Leaky pipes may flood a mould ready to be cast or dampness may be absorbed to such an extent that, not only would it be a danger to the resulting casting, but it would imperil the lives of the men engaged in pouring the metal. These cases, as they are called, are now in common use, their sizes varying according to the particular work for which they are required. In foundries where large castings are made, at least one very large case is sunk in the floor to accommodate exceptionally large work, but partitions should also be prepared in order that it may be used for smaller work when not fully occupied with a large job. A modern form of case suitable as an example is shown in Fig. 14. It will be noticed that the area is larger at the top than at the bottom, in the older forms the sides were parallel and they offered considerable resistance to the withdrawal of the work after it had been cast. The tapered sides reduce this difficulty, and, incidentally, much of the sand is removed with the casting, which is an economical consideration. In order to make the cases watertight the bottom plate is flanged externally, a clearance of at least ½ in. being allowed between the case sides and the flange, which is rammed up with iron borings to which sal-ammoniac has been added, so that a rust joint is formed.

Box Pins.

The time was when the correct relative positions of box parts were located by means of marks made on a daub of loam, and while it was not considered

to be good practice, at all events it was considered to be passable. To-day considerable attention is given to the degree of accuracy by which box parts register. Fins on a casting can be excused; as a matter of fact, in many classes of work they are an advantage, but an overlap due to defective fitting pins is a source of discredit. The amount of clearance between the pin and pinhole should be as small as is possible for a clean lift. Smaller boxes can do with less clearance than larger boxes because they are more easily located in a horizontal direction. The pins should be tapered so that they engage easily. The sectional shape of pins varies to a certain extent, thus on wooden snap flasks it is usually triangular, but the more general shape for ordinary boxes is round. Other shapes have been used with varying success, but the circular pin predominates. The most convenient number of pins on a box is frequently a debatable point, but the smaller the number the smaller the clearance that is necessary, thus for small boxes two pins suffice, while four should be used on large boxes as a means of gauging the cope parallel with the drag as well as to register the parts accurately. There is the difficulty with an even number of pins, that are on the centre or symmetrical about the centre of the box, that they are not fool-proof, they may set the wrong way with disastrous consequences to the mould or to the casting. Many efforts have been made to circumvent this danger without adding another pin—a practice which has fallen into disuse—by altering the shape of one of the pins, in the case of a two-pin box, or by varying their positions on a four-pin box, so that they can only be assembled in one way, but with little effect on the general practice.

Many contrivances are adopted for making use of the pins to secure the parts together to resist the pressure of the metal. In some instances slots are cut through the pins to receive cotters or wedges, in others the pins have a lip or flange at the top which passes through a slot hole in the lug, and wedges are introduced between the projection on the pins and the lug. We are of the opinion, however, that pins should be used for registering only, as knocking them about with wedges does not improve their degree of accuracy and the boxes are quickly rendered unworkable.

Another form of guide is necessary when the foundry floor or a case is used for the mould to locate the cover box accurately. Iron stakes are used for the purpose, either square or round bar iron or angle plate may be used. They are driven into the foundry floor and allowed to project in such a manner that they are in contact with the cover box. At least four are necessary, but frequently more are used.

Contracts Open.

Birmingham, August 29.—Supply of about 2,400 tons of 18-in., 24-in., 27-in., 36-in., and 42-in. vertically cast S. and S. iron pipes, each 12 ft. long, and irregulars, for the Corporation. The Distributing Engineer, Gas Department, Council House, Birmingham.

Bombay, October 10.—Supply of galvanised pipes and fittings and gunmetal ferrules, taps, etc., for the Municipal Commissioner, Bombay. The Storekeeper, Storekeeper's Office, DeLisle Road, Byculla.

Brighton, September 18.—Supply, delivery and erection of two water-tube boilers, with superheater, economiser, steel chimneys, etc., for the Corporation. Mr. J. Christie, Electricity Department, North Road, Brighton. (Fee £2 2s., returnable.)

Melbourne, January 15.—Supply of four water-tube boilers, each 4,500 sq. ft., with pumps, piping and structural steelwork for boiler house, for the Victorian Electricity Commission, 22, William Street, Melbourne.

Pinchbeck, Lincs., September 2.—Supply of about three and a half miles of new water mains, 3-in. diameter, for the Spalding Rural District Council. The Clerk, Spalding, or Mr. E. J. Silcock, 10, Park Row, Leeds. (Fee £5, returnable.)

Wetwang, Driffield, September 6.—Construction of an underground rain-water cistern in reinforced concrete at Wetwang, for the Driffield Rural District Council. Mr. G. Harker, clerk, 17, Exchange Street, Driffield.

MESSRS. DANIEL ADAMSON & COMPANY, LIMITED, of Dukinfield, near Manchester, have received an **order** for one of their latest patent electrically-driven crude sewage lifting plants for Messrs. Cropper's new factory at Thatcham, Berks.

A New Puddling Process.

In a recent issue of the "Iron Age" a new mechanical puddling process is described.

The principle of the process, which is the invention of Henry D. Hibbard, is in making a charge of molten iron and oxide of iron pour repeatedly over a dam. An intimate mixture of the two ensues, with a rapid change of the iron to the wrought state. The presence of this dam causes the material to spill over the top in a thin stream as the furnace is oscillated back and forth in operation. This makes for thorough mechanical mixing, and goes far to explain the homogeneity reported in the product.

The melting stage is carried on in a cupola, as considerably less expensive than melting in the puddling furnace. From Fig. 1 it will be seen that molten iron goes into the furnace through one hollow trunnion (the oil fuel is introduced through the other trunnion) and the purifying, boiling and balling stages take place within the furnace. In all three of these the operation, mechanically, follows the hand method, both in the chemical and physical aspects. The carbon is removed, just as in the hand method, during the boiling process, while in the balling process the plastic grains unite and form the sponge. A mixture of grey forge pig-iron and scale is used.

Essentially, the furnace consists of a cylinder of steel plate about 6 ft. in diameter and 5 ft. 6 in. long, with projecting trunnions 18 in. in diameter. The cylinder is lined with magnesite brick to an

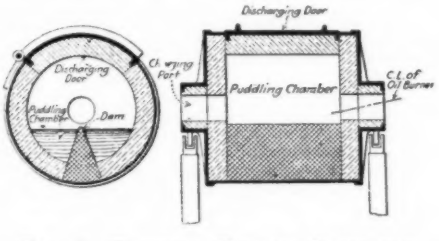


FIG. 1.—PUDDLING FURNACE INCORPORATING THE PRINCIPLE OF MIXING BY THE DAM SHOWN. THE BALL IS REMOVED BY THE DISCHARGING DOOR.

inside diameter of about 4 ft. The dam, which consists also of magnesite brick, extends up nearly to the centre line. On the surface of the brick a skim of iron is sintered to perhaps ½ in. As this protects the brick both from mechanical damage and from the action of the hot metal, the refractory situation is reported as not causing trouble. The operation is carried on at a temperature of about 1,455 deg. C., the flame being 1,565 deg. As soon as the iron "comes to nature" and begins to form into a ball, the oscillating motion of the furnace is stopped, and it is rotated clear over. Eventually the door, which normally is at the top of the furnace, is opened, and out of this door the balls drop upon a conveyor.

Some of the physical and chemical results obtained from this iron are shown in the table. The iron is used largely for pipe and sockets, for engine bolts, stay bolts and high-grade merchant bar. It is reported that the chemical analysis presents great uniformity from one heat to another.

	Pipe and Socket Iron	Stay Bolts and Merchant Bar
C. per cent.	0.022	0.030
Mn, per cent.	0.031	0.022
Si. per cent.	0.220	0.200
P. per cent.	0.128	0.042
S. per cent.	0.025	0.013
Tensile strength, from ..	20.0 tons	21.4 tons
to ..	22.3 tons	23.2 tons
Yield point, from ..	11.2 tons	11.6 tons
to	13.4 tons	14.2 tons
Elongation, per cent. (in 8 in.)	15 to 20	25 to 30

The patents of this process, which are world-wide, are being exploited by the Hibbard Process Corporation, 71, Broadway, New York, U.S.A.

Small Runners and Sound Castings.

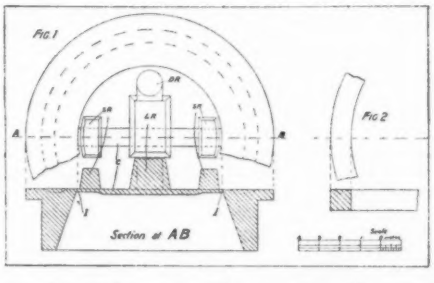
BY ECOSSAIS.

The writer has followed with interest the recent articles and papers on the methods of producing sound castings without feeding heads by the use of small runners. Many foundrymen of experience would be able to confirm the good results obtained by a careful review of their past experience, tending to prove that while the application of small runners systematically may be a novelty, the results themselves have been obtained years ago. The very people who obtained the results, however, would have ridiculed the idea that small runners had been the means, or, in fact, had anything to do with these same results.

Cylinder Liner Practice Detailed.

Mons. Ronceray has asked that foundrymen should experiment and make public their results. However, by carefully examining past work most foundrymen could give instances similar to the one it is proposed to detail.

It is common practice in casting hollow, cylindrical castings as liners to have a sink head to ensure soundness and receive the scum which forms on the top of the metal, due to the agitation caused by the falling and splashing of the metal from the runners, which are generally much smaller than would be used were the casting poured horizontally. Although a liner, being of fairly uniform thickness, could not be compared with a more complicated casting, still, in comparison of a number of liners cast with similar metal, some uniformity should prevail, unless some other factor was present to affect results. In this connection the writer has seen widely different appearances in the heads, after removal of liners of the same



size and metal, cast in dry-sand moulds. Some would have a distinct pipe, open at the top of the head, others apparently would be quite solid but with rounded edges. The latter would apparently be explained by a later occurrence with a smaller liner. This had a somewhat larger core than the prints provided for it, with the result that there was a tendency to crush when the top half of the box was put in position. When turned on end for casting, the runners, three in number, were only about half the thickness they were intended to be, and there were doubts as to whether some of the prints had not crushed in clamping up; also as to whether the mould would fill. However, the metal was poured and went in extremely slowly, and apparently was hopeless. When knocked out next morning, the feeding head, usually 6 in., only measured 4 in. The top was apparently solid, but the edges were round, as if the metal at the top had been fairly dull, though the casting machined perfectly. Turning back to the larger liners, the writer can only form the opinion that the liner heads not showing a pipe had smaller runners than those with the pipe, which accounted for the rounded edges. As all the runners were cut out by hand, this could easily occur, and in the event of a loosely-fitting core, the area might be easily doubled or trebled, a fact best known to the man who cast them by the ease or otherwise of "keeping up" the runner.

Method of Casting Detailed.

Fig. 1 shows a half-plan and section of a casting which some two years ago gave a little trouble. These were cast in close-grained, low-silicon iron, when cast by sprays on outer circumference, almost always showed depressions, as indicated in sectional view by dotted lines; even when three risers of 1¼ in. diam. were placed on top, the results were not too good. After a little experimental work the design of runner shown in the centre of the ring was decided upon.

The top part of moulding box was 5 in. in depth and a well was scooped out, to supply the down-runner DR, 1¼ in. dia. This was connected direct to the large reservoir LR and by the channel C in the drag part to the smaller reservoirs SR. The metal entered the casting at points I, the channel C having been contracted to a depth of 3-16 in., being ⅞ in. wide, a kind of half-round spray, the sectional area being equal to that of a segment of a circle with a ⅞-in. chord and a segmental height of 3-16 in. This was certainly a very small runner as compared with original runners. The three reservoirs in the top box were all pattern-made, the connecting channels being cut by hand.

With the runners shown, defective castings rarely appeared, except very occasionally, and due to dull metal, wet sand, or too hard a face. With the stiff metal there would be a misrun, and in the other cases blowholes would be plainly visible. These castings machined up perfectly sound, and several were broken and did not show any signs of "sponge." The results being so good, the same type of runner was tried on the gear blank ring, shown in Fig. 2, which with the metal used had given trouble owing to slight depressions appearing on the face of castings. With the above type of runner this trouble was also overcome.

The writer was puzzled to account for the success of the runner, which could be described as more or less accidental, the intention being to provide four large lumps of greater section than the casting, and at a short distance, say ⅛ in. from it, connection being made by a small ingate. Space did not allow four, and eventually it dropped to two, with a central feed, these being reduced in size by the moulder because they weakened the top box, until the section shown was reached. Obviously they do not act as feeders, but keep the metal hot enough to flow through the small inlets I.

Theory Discussed.

Therefore, on reading the articles dealing with castings without feeding heads, the writer was convinced, and now supports Mons. Ronceray when he states that "there is something in it." With a casting with a relatively large surface area and slow filling, the metal would require to be exceedingly hot, and the cope well reinforced, or there would be a misrun on the one hand or a collapse of the cope on the other. It has been customary for many years with certain jobs made by piece-workers to put very small ingates to castings for the sake of prolonging pouring. These would ordinarily have been cast with dull metal, but which, owing to the workman's eagerness to get good casting, are cast as hot as can be obtained from the furnace. The result is solid castings are obtained. These castings would certainly have sunk if cast so hot with a gate of ordinary size. Evidently, with a gate of large section, and metal passing through rapidly at a high temperature, that portion becomes superheated, to a greater extent than can possibly occur with a small channel, which by gradual filling tends to confirm one writer's theory that the temperature of the mould at all parts is approximately the same.

[It is not quite clear whether the author intends to convey the idea that the making of small area gates would give the moulder the right to demand hotter metal, or the surface area of the runner being so much less would extract less heat from the metal in passing through it. A smaller channel would more rapidly be heated to the temperature of molten iron, and when this temperature is reached the extraction of heat would be negligible. With larger-sized runners, although the passage of the metal is quicker, the extraction of heat would be greater.—EDITOR.]

British Engineering Standards Association (28, Victoria Street, Westminster, London, S.W.1).—This Association has issued among others the following Standard Specifications for Aircraft Material:—No. 2 A.3, Straight Steel Eyebolts for Flexible Steel Wire Rope; S.40, Extra-High-Tensile Alloy Steel Strip; S.43, Medium-Tensile Alloy Steel Strip; S.46, Nickel Steel Strip; 2 T.4, Wrought Light Aluminium Alloy Tubes (Duralumin).

Plaster Patterns.*

By C. HEGGIE (Oldbury, Birmingham).

Material Used.

Plaster of Paris, or stucco, as it is more commonly called in Scotland, is obtained from gypsum, a mineral of comparatively soft nature. Chemically it is a hydrated sulphate of lime, $CaSO_4 2H_2O$. It contains roughly 21 per cent. of water, or say, four-fifths sulphate of lime and one-fifth water. Usually it also contains 10 per cent. calcium carbonate, not necessarily in intimate union with the sulphate, but interspersed in grains. The water of hydration was driven off by baking, and the residue was then ground to what was known as plaster of Paris, which he understood was now recognised as the hemi-hydrate $2CaSO_4H_2O$. This substance still contained 7 per cent. to 8 per cent. of water, and it had the most valuable property of being able to re-combine with water to form a soft paste, which could be run or strickled to the desired shape before becoming hard. When the plaster was added to the water it dissolved and formed a saturated solution. The solution was super-saturated in respect to the hydrate, and some of the dissolved salt separated out in the form $CaSO_2HO_2$, thus setting free some of the dissolving water to dissolve more of the plaster, the process being repeated until the mass became set. After setting it must be considered a solid solution of $Ca\ SO_4$ in water, the particles of plaster being converted into a network of crystals, mechanically enclosing the remainder of the water. There were many kinds and qualities of the plaster, the three most common being superfine, fine, and coarse, but most shops stocked only fine and coarse. Only those two were necessary, except, perhaps for high-class ornamental work. Some splendid work could be done with the fine material, which could be improved, when necessary, by passing it through fine sieves. The coarse plaster is used to run up the pattern blocks or the heavier class of patterns where the thickness or section was suitable. Such patterns and blocks are usually finished with a coating of fine plaster. The quality of the powder can be tested by squeezing it in the hand, much in the same way as sand was often tested. Good plaster would cohere slightly when the hand is opened; otherwise it would fall to pieces, generally indicating injury by damp. It should be kept in a metal or wooden box with a suitable lid, to protect it from dust and damp. The addition to the box of an inside hopper and sliding scale was an improvement, as by this a minimum exposure was obtained. The vessels used for mixing should be free from sharp corners, and with well-tapered sides if at all deep. A basin-shaped vessel with a handle and two small spouts for pouring was best of all, because it was easily cleaned and it exposed a large surface of water when the plaster was being added. The vessels should be kept clean and fresh, and clean water always used.

Mixing.

In regard to mixing, no hard and fast rule could be laid down as to the proportions of water and plaster; each job must be considered on its own merits. But, speaking generally, a mixture of a consistency equal to that of a good cream would give the best results. The water must be first placed in the vessel, and the plaster then added. It should be sprinkled well over the water, giving it every chance to dissolve thoroughly. The addition of the powder should be continued in this manner until it was seen in a small pile over the water. It should then be quickly stirred, but excessive stirring weakened the mixture. Nor should plaster or water be added after mixing, as the plaster was thereby weakened; additional plaster evolved heat, and caused swelling and warping of the pattern. He had made no recent experiments as to the proportions of water and plaster, but the figures he gave on the previous occasion were arrived at after careful trials, and he had no reason to doubt their accuracy. The method of testing was to push strips of plaster over the sharp edge of an iron plate until they dropped off, and then find the length of the part broken off by measuring the remaining piece. Two sections were used, $\frac{3}{4}$ by 5-32 and 1 by $\frac{1}{4}$. To decrease the length of the pieces broken off so that shorter test pieces could be used a weight was suspended from one end. In the first case it weighed $\frac{1}{4}$ lb., in the second case $\frac{1}{2}$ lb. The results were summarised in the following table:—

Proportions of Water and Plaster by Weight.

	W. P. 8 6	W. P. 8 8	W. P. 8 10	W. P. 8 11	W. P. 8 12
Section $\frac{3}{4}$ in. × $\frac{5}{32}$ in. (weight $\frac{1}{4}$ lb.)					
Hours.					
2 ..	2 in.	3½ in.	4⅛ in.	—	5½ in.
26 ..	3⅛ in.	6⅜ in.	7½ in.	—	9¾ in.
Section 1 in. × ¼ in. (weight ½ lb.)					
2 ..	3¼ in.	5 in.	7 in.	7½ in.	8½ in.
26 ..	3 in.	4¾ in.	6⅝ in.	7⅛ in.	8⅛ in.
Carelessly Mixed and Overworked Plaster.					
Hours.					
2 ..	—	—	—	—	4½ in.
26 ..	—	—	—	—	4¼ in.
With Lime.					
2 ..	—	5½ in.	7⅛ in.	9⅞ in.	8⅜ in.
26 ..	—	5⅜ in.	7¼ in.	9½ in.	9¾ in.
With Alum.					
2 ..	—	4⅜ in.	5⅜ in.	—	8 in.
26 ..	—	3⅜ in.	5½ in.	—	6¼ in.

Though these figures might have no real value in themselves, they indicated that correct mixing and proper proportions are essential to a sound job. It is also essential to do the job quickly and, where possible, with one mixing of the plaster. Continual mixings and an excessive use of the template made the patterns weak and rotten.

Demands for Various Work.

In large work, where the mixture would be likely to set before completion, setting could be retarded by the use of several materials such as lime, size water, ammonia, and sulphate of zinc. The most common was lime. It should be slaked in a separate vessel, and the lime water used after passing it through a fine sieve. It was said that this also hardened and strengthened the work. Alum water was also used to harden the work and quicken the setting. Like lime, the alum should be dissolved in water, and the solution added to the neat water and stirred before adding the plaster.

For solid round patterns of an ornamental character plaster of Paris would in many cases give quicker and more accurate results than by turning the pattern in wood.

For fine and accurate work it was customary to use sheet zinc for the templates. Two pieces of zinc were cut to the necessary size, and the outside shope of the pattern was marked out on one of them and carefully filed to the drawing; the second piece of zinc, used for running the block which formed the inside of the pattern, was marked off from the first, less the thickness of metal required. It was advisable to fasten the two together (a stitch with solder was customary), and drill screw-holes for fastening to the strickle. The block template could then be finished accurately, as the thickness of metal could be measured from the face template. When the block had been run up the template was removed and the face template replaced, the screw-holes ensuring the correct position. In work where the finish was not so important, and when the template was not

* A Paper presented before the Lancashire Branch of the Institution of British Foundrymen. The Paper was illustrated by lantern slides and practical demonstrations given, in which the author was assisted by Messrs. Christie and Robinson.

likely to be again required, the strickle was cut to the required shape, the thickness being cut out after the block had been run up, as was done in loam work in the foundry.

Special Cases of Templates.

For a 6 ft. gutter, the block was first run up, and then varnished with ordinary shellac, and oiled. As a rule zinc templates were used for this class of work. It was usually necessary to sweep or camber the plaster patterns to ensure a straight casting, owing to the irregularity in the cooling of the iron patterns and the castings from it. Instead of sweeping the board to the desired curve, the ordinary practice was to use a straight board and place upon this strips of wood termed risers. These were planed to the required sweep, and the strickle took its bearing on them, the edge of the strickle engaging with the edge of the riser. In the case of a circular gutter the edge of the riser would be curved to the necessary radius, the edge of the strickle engaging with this in the usual way. These risers could be easily altered or replaced to suit the necessary cambers for the varying sections of the patterns. The gutters were made from 1-10 in. thick, and for convenience in handling the plaster was usually cut longitudinally in two, the two portions being afterwards cut into five or six pieces.

Many straight patterns made as described were not complete in themselves, castings being made from them in some of the white-metal alloys. These were finished by filing and chasing, and were then soldered together to form the complete pattern. In many cases, however, the " plasters " might be assembled to form the pattern.

Circular Patterns.

The production of circular patterns in plaster was simple and cheap, and a regular thickness was assured, while to build and turn up the same in wood would take a fair amount of time and be more expensive in material. Fine plaster in the form of patterns cost about one-half as much as the best yellow-pine for the same number of cubic inches. As a rule, there was the initial expense of an own pattern, which, however, had many decided advantages over one of wood. One of the greatest disadvantages of the latter was its liability to warp.

Large Blocks.

Where large blocks were required it was usual to reduce the weight by packing up with material of lower density. Wood lagging might be used, but its tendency to swell and warp when in contact with the plaster made it undesirable. Even where the wood was thoroughly soaked before using there was still the risk of the block becoming warped when the wood dried. The most common practice was to use coke. The coke was built up so that a suitable thickness of plaster, say ¾ in., could be run on the top of it. A wood centre block is screwed to the board and carried the socket or plate in which the pin of the strickle revolves. Sometimes the strickle is made in two pieces and jointed, simply for strength and to save material. There was a centre line on the plate, so that it might be screwed accurately without trouble. The zinc template would be used for this, but the wood was bevelled well back, leaving the actual cutting edge. The face and edge of the template should now be varnished and oiled, as should also be the back of the template on the board. Besides assisting a freer movement this facilitated the more ready removal of the superfluous plaster. After ascertaining that the position of the template would give the required diameter the plaster was mixed and the block run up. The thickness of the metal must now be cut from the template, the block being touched up where necessary and varnished and oiled. Very little oil was needed. Beginners often used it in excess, with the result that it collected in angles and corners, causing them to be blunt and rounded when they should be sharp. It should be noticed, while strickling, that no part was being missed, as this neglect might create a necessity for additional mixings of plaster and a prolonged use of the template over the whole job, adding to the expense and detracting from the quality of the work. All these patterns were cut into suitable pieces for handling by the moulder.

In running a bead on to plaster already partially set, the plaster should be roughed and damped. The new plaster would adhere very much better if this was done.

The spindle and swing centres were useful for the making of pipe faucets and spigots and other round work. With the swing centre a half-pattern only was made, and in many cases this was all that was necessary, as both iron halves were the same. These patterns were used chiefly as shell patterns, but when core boxes were used they were made from the same plaster.
on the vertical spindle.

Guide and Track Work.

One of the most useful methods of plaster-pattern making was guide and track work. The principle was to supply a guide or track for the template. All sorts of irregular-shaped work could be made in this manner. A good example is a triangular plate with a moulded edge. On the board is fixed a riser strip, the edge of which acted as the guide for the template. Only one block was run up, and this was used to run the three sections on which, when joined together and placed on the foundry board, formed the complete pattern, the block being broken up and the parts distributed to support the pattern. Other examples of this class of work are a pillar guard, the leg of a mantel register, and the end of a cast-iron column for a pier.

The making of ovals might well come under the name of " track work," although it was more on the principle of circular work. Take a simple oval frame 3 ft. x 2 ft. A wood strickle and zinc template would probably be used, and the centre line marked off at half the length of the major axis, 18 in. A second centre line would then be marked off at half the length of the minor axis, 12 in. or 6 in. distant from the first. Two centre plates are screwed on at these positions. In the board, or in a plate screwed to the board, two grooves are cut at right angles to each other and of a size suitable to form a sliding fit with the centre pins, or with loose slides in which the pins fitted. As the strickles are moved round the centre pins travel along the slots, one in each, so that by the time a quarter of the oval has been run, the template has travelled 6 in. nearer the true centre of the oval. An oval lavatory basin would be treated in much the same way, the slotted plate being carried by a wood centre screwed to the board. In large oval work the cross could be carried by a wooden frame, built outside the track of the template. In such a case the template would be suspended from the cross by two bolts, which took the place of the pins used in smaller work. Sometimes the templates were fitted with wheels to give an easier movement.

The patterns already discussed have been finished direct from the template, but there are cases where this could not be done. Parts had to be pared to shape, additions made, curves altered by hand or by the use of further templates, etc., and the whole assembled and made ready for the foundry. In the case of a fluted dome, the block is run up in the usual way, but the flutes have to be pared. The flutes on the block are carefully marked—the template being used for this, as the lines are radial—and then hollowed out. This forms the back or inside of the pattern. Before running the thickness, centre lines must be marked on the board to ensure the flutes being marked and pared in the pattern exactly over those already made in the block.

Three-Way Pipes Considered.

A three-way pipe is another pattern that must be partly shaped by hand. The sockets might be run up on the spindle, or with the template swinging on centres. In most places iron standard sockets would be used. The 12-in. and 7-in. dia. pieces would be run up on a straight board, as would also be the core-prints. On the top of the core-print an extra thickness should be run, this to be used later when altering the pattern to the core-box. The whole is then placed in position on the board, care being taken that the centre lines of the main pipe and branch pipes are correct, as both halves of the pattern are made from this. The centre part of the block is now filled in with additional plaster and finished off to shape. The thickness to form the pattern is then poured on, small pieces of wood equal in thickness to the metal required having been pre-

viously placed on the block as a guide when this part is being pared. When the half-pattern has been cast, the plaster is altered for the core-box. The pieces which were run on the top of the prints are now placed in position, the prints themselves becoming the block for same. The outside of the pattern is then strengthened by strips, etc., snugs put on for pins and handles, and the two halves of core-box cast from it. In many cases of this class of work shell patterns are made and no core-box used.

Locomotive Domes.

Another interesting example of circular work where parts had to be pared by hand is the making of locomotive domes and chimneys. In the making of the bottom part a board was first prepared, 6 in. or so larger than the diameter of the base. A block of wood to act as the spindle, and with the plates or socket for the pin of the strickle already in, was then fixed to the board. Centre lines were projected on to the board from the centre of the spindle. The spindle is then removed for the time being, and two wooden strips, curved to the radius of the boiler, are screwed to the board at a distance greater than the diameter of the base, and central with the lines on the board. A piece of wood slightly larger than the diameter of the spindle, and less than the height of the strips, was then fixed at the centre of the board, simply to keep a hole clear for the spindle when used later. The space between the wood strips is then filled up with plaster and scraped off with a straight-edge to the curve of the strips. This plaster block was pared to a diameter slightly larger than the base, and the spindle was replaced in the board. A strickle having been prepared to the inside shape of the dome, the plaster base is varnished and oiled, and the block forming the inside of the pattern is run up. On this four or eight vertical lines—the more there were the more accurate would be the job—were projected, the strickle being used to mark them off. The block is then pared and gradually worked in to the curve made by the strickle. When the whole of the block has been treated in this way, the required thickness of metal is cut out of the strickle. Small pieces of wood, equal in thickness to the metal required, were distributed over the pared curve, and these act as guides when the outside is being pared later. The thickness or pattern is run on and the curves pared as before. Other parts of the pattern, being circular, are run up in the ordinary way. The iron patterns, after being filed or turned, are used as shell patterns.

Other Uses.

Plaster could be used in many ways other than making complete patterns. Perhaps a large quantity of core-prints are required, snugs, small ornaments, etc. By making two or three, according to the size of the print or ornament wanted, and casting a plaster mould from them, plaster casts of the required part could be produced quickly and with assured accuracy.

Perhaps the most useful of the more simple plaster jobs is the familiar odd-side. By having the two odd-sides, one cast in plaster on the top of the other, accurate joints are obtained, and the tops and drags can be made from them on bench or machine. In such case, the patterns, of whatever material they were made, would be used on the odd-side. Plates could be made completely of plaster in the same way. To make a complete reversible plate—by which is meant a plate from which both top and drag were rammed—the method is much the same as that used to make such plates in cast-iron.

The moulding-box would have a centre bar, and the complete sand mould would be made in the usual way in one of the divisions. A similar box or frame for the plaster was placed on one part of the mould, and plaster poured over this in one of the divisions. When the plaster is set, the frame is removed and placed on the second box, with the remaining open space over the mould. Plaster is poured over this, thus giving a complete plaster plate. Projections, corners and other weak parts that might easily be broken are often strengthened by white metal. This could be nailed on or placed in the mould before the plaster was poured in.

With regard to the following notes, the author cannot guarantee their accuracy, but thought they might be useful for experimental purposes to those interested.

The addition of 5 per cent. of cornflour rendered the plaster hard and tough. Pulverised marshmallow roots, or water in which they had been boiled, added to the extent of 4 per cent., retarded setting for an hour, and then it could be filed, sawn or turned. Eight per cent. further retarded setting and increased hardness. Plaster casts could be hardened by soaking in a strong solution of alum. This, in combination with the marshmallow, made plaster as tough as wood and as hard as stone.

Discussion.

THE CHAIRMAN (Mr. W. H. Meadowcroft) said the members were not all concerned with plaster work, but many things connected with it were applicable in ordinary sand moulding. This was a unique opportunity of seeing it actually demonstrated, and everyone must have found it interesting.

MR. MCLOUGHLIN asked how Mr. Heggie would proceed in the case of a fillet between two right angles. Would he use any wood at the corner, or simply fill up with plaster?

MR. HEGGIE said, in an ordinary way, he would not use any wood, but simply a few sprigs driven in to hold the plaster at the edge. Where the plaster was thin at the edges a groove in the wood thickened the plaster and strengthened the job.

MR. HOGG moved a vote of thanks to the lecturer, to the demonstrators, Messrs. Christie and Robinson, for the admirable way in which they had illustrated the mixing of the plaster and the production of the patterns, and to Mr. Clayton for bringing the materials. They were all members of the Institution, and this meeting was a signal proof of the good work which was done by it. One firm, which went in for fancy brackets and ornamental work, never put it into wood; they made plaster patterns and sent them out to the foundry to be reproduced in iron or a non-ferrous metal as soon as possible.

MR. H. SHERBURN said he had been closely associated with work of this kind for many years, and he had often wished to bring it up at a meeting of the Branch. Now that the members had heard Mr. Heggie's lecture, and seen the amount of preparation which had been necessary, they would understand why he hesitated to undertake the task. It would be an excellent thing if a similar demonstration were given through the Institution. To many engineering pattern-makers the methods adopted might seem to be unorthodox, but in many cases they were far more mechanically accurate than any other known process. If the pattern-makers would give heed to what had been said that afternoon, they would find their work would become easier, and perhaps in some ways pleasanter. Many castings that were now made could not have been produced if the system outlined were not available, and they were deeply indebted to Mr. Heggie and the demonstrators for the lucid exposition which had been given, which had been full of interest, and would doubtless open new possibilities of pattern work to many of their members.

MR. SIMKISS, in supporting the vote of thanks, said plaster patterns were by no means a new thing. In Manchester, a few years ago, a lecture was given on the subject, and for some time afterwards a quantity of such patterns were produced instead of wooden patterns. Some were similar to what Mr. Heggie had shown on the board. They were of rather large dimensions, and more costly to produce castings from; therefore prices went up, and to some extent that stopped the making of plaster patterns. He had heard of Keen's cement being used, but he had no experience of it personally. Perhaps Mr. Heggie could tell them something about that. Unless plaster was handled rapidly, it lost its nature, and could not be induced to set hard under certain conditions; mixed with Keen's cement, one had more latitude as to the time.

MR. HEGGIE said he knew Keen's cement was used in conjunction with plaster, but he had not made any experiments with it. He had always found that plaster was quite good enough for the work that he did.

The vote of thanks was passed unanimously.

Eliminating the Gas Regenerator Chambers in the Open-Hearth Process.

In a Paper read before the American Foundrymen's Association at its recent annual convention, MR. WILLIS MCKEE, after describing the use of the blow-torch or Bunsen-burner principle in its application to open-hearth furnaces, remarks that this process of combustion has opened up quite a number of possibilities for the further improving of open-hearth construction which deserve serious consideration. In Fig. 1 is shown a part section of an open-hearth furnace in which the regenerators are encased with insulating bricks and steel platework. Inasmuch as the use of the steel platework enables the use of much thinner walls, it is evident that this construction is little more expensive than that which is now used, while the saving due to decreased heat losses is appreciable. Furthermore, the regenerator chambers can be maintained in much better shape and the temperature of the basement is materially decreased, making it much more livable.

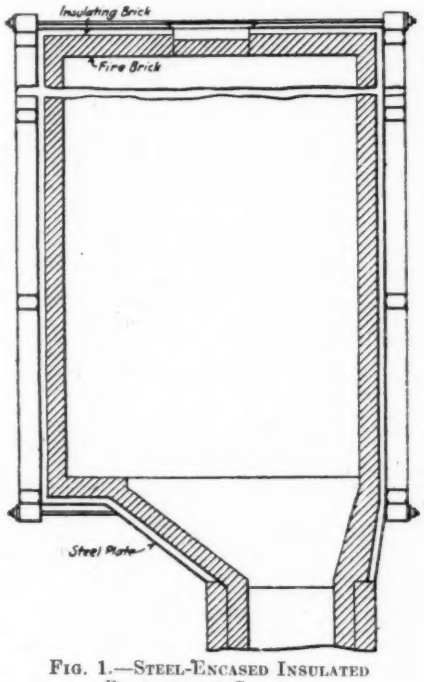


FIG. 1.—STEEL-ENCASED INSULATED REGENERATOR CHAMBER.

A more radical departure is the eliminating of the gas regenerator chambers when using producer gas, as shown in Fig. 2. It is proposed to locate the gas producers comparatively near to the open-hearth and conduct the gas in suitable steel mains, properly insulated, to the ends of the furnace and introduce the gas into the air uptakes without any regeneration. This practice becomes possible only by the use of the blow-torch principle, where the air and gas thoroughly mix before they issue from the port so that the resultant temperature of the mixture is the only temperature that needs to be considered. Inasmuch as approximately 800 deg. Fah. stack temperature is now obtained in a blow-torch furnace, it is evident that the temperature of the gases escaping through the air chequers is much lower than those escaping through the gas regenerators, as the incoming gas cannot possibly lower the temperature of the gas chequers below 1,050 to 1,100. Therefore, it is evident that by making all the gases escape through the air regenerators the temperature of the incoming air will be considerably higher than when the gases are divided, and the resultant temperature of the mixture of gas and air will be substantially the same as at present.

This construction appeals strongly to those to whom it has been suggested, because it eliminates the gas loss that now occurs whenever the furnace is reversed, when not only all the gas from the end of the port back through the generators to the gas valve is lost, but with most designs of valves the gas in the mains back to the producers is exhausted by being connected to the stack during reversals. It eliminates the hydrocarbon loss which now occurs in the regenerators and the difficulties due to the clogging of the gas chequers. This construction greatly decreases the volume of the slag pockets and the heat losses due to radiation from the excessive space between the chequers and the ports. Structurally this construction is exceedingly desirable, as it greatly decreases the cost of the furnace and shortens the distance required from centre to centre of furnace by 5 to 10 ft. It also eliminates the centre wall in the slag pockets and the need of overhung brickwork in the uptake.

The author concludes by expressing his opinion that the transition through which the open-hearth is now passing will so increase the capacity of existing units that there will be practically no construction of new open-hearth plants required to meet the demand for steel for a number of years, but that one of the biggest problems incident to the introduction of the rapidly operated furnace will be to get the raw material to the furnace and to handle the material on the casting side. While previous inventions in the open-hearth have had for their object increasing the comfort of the operators and the decreasing of the shut-downs and repairs to the furnace, he is of opinion that the effects of this invention are so far-reaching that it is difficult to appreciate the magnitude of the development. The principal advantages claimed are:—(1) Better steel; (2) increased fuel economy; (3) greatly increased output; (4) longer life of the furnace; (5) possibility of using a higher percentage of scrap; (6) decreased plant cost for a given capacity. By using unregenerated producer gas as proposed, it should be possible to obtain the following additional advantages:—(*a*) Additional fuel economies; (*b*) greatly decreased cost of construction; (*c*) simpler construction.

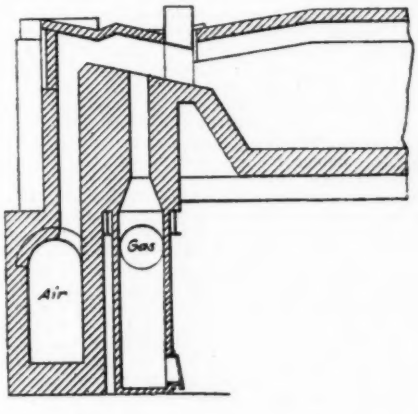


FIG. 2.—SECTION THROUGH COMBINED PORT DESIGNED FOR UNREGENERATED PRODUCER GAS.

The Institute of Metals.

The forthcoming Swansea meeting of the Institute of Metals will see the inauguration of a series of annual public lectures on subjects of practical interest for those engaged in the non-ferrous metals industry. The lectures are additional to the annual May lectures of the Institute, which have constituted a notable feature of their work since 1910.

Dr. R. S. Hutton, a Member of Council of the Institute, and Director of the British Non-Ferrous Metals Research Association, is to deliver the first of these lectures, his subject being "The Science of Human Effort (Motion Study and Vocational Training)." The lecture will be given at 8 p.m. on Tuesday, September 19, at the Y.M.C.A., Swansea. Tickets can be obtained from Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

Trade Talk.

Instructions have been received in Belfast to begin the building of an Atlantic transport liner of 17,000 tons, and to resume work on two large oil tankers.

The report, published in the Press last week, that Messrs. Armstrong Whitworth had received a large Government contract has been contradicted by the Admiralty.

Mr. D. McLain will lecture on "Semi Steel and Cupola Practice," before the Newcastle and District Branch of the Institution of British Foundrymen, on September 2.

A contract has been received by the Westinghouse Brake & Saxby Signal Company, Limited, to provide the signalling material for 120 miles of alternating current signalling for the New Zealand Government Railways.

The "Natalina," a large steamer, built at the Furness Shipbuilding Yard, Haverton Hill, for Furness Withy's American trade, has arrived at Hartlepool, where she is to be fitted with geared turbines of 5,000 shaft horse-power, built by Richardsons, Westgarth & Company.

At a recent meeting the Organisation and Management Committee agreed that the support of the F.B.I. should be given to the request of the Trade Marks, Patents and Designs Federation for co-operation in urging the adherence of the United Kingdom to the Madrid Arrangement for the International Registration of Trade Marks.

Engineer Vice-Admiral Sir George Goodwin, K.C.B., late Engineer-in-Chief of the Fleet, and Dr. James Colquhoun Irvine, C.B.E., F.R.S., Vice-Chancellor and Principal of St. Andrews University, have been appointed to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

The washery at the Senghenydd pit owned by the Lewis Merthyr Consolidated Collieries, Limited, in South Wales, is being remodelled by Messrs. Head, Wrightson & Company, Limited, of Stockton-on-Tees. They are installing their well-known "Nota Nos" coal washers, also their fine-dust extraction plants for a capacity of 70 to 80 tons per hour.

No less than 30,000 names are registered for the evening classes provided by the Glamorgan Education Committee. Of these, about 500 are annually eligible for the summer mining courses at the University College, Cardiff, and the Penarth County School. The subjects treated include electrical engineering, mechanical engineering, economics, physics and chemistry.

Branches of the Boilermakers' Society have been advised to take a vote of their members during next month as to whether the organisation shall any longer continue affiliation with the Engineering and Shipbuilding Trades' Federation. The society's executive, while facilitating the ballot, points out that already big modifications in the constitution of the federated trades are imminent, and it is itself not desirous of seeing the society pursue a policy of isolation.

Recently the New Zealand Government placed with Messrs. Vickers, Limited, orders for two Pelton turbines, which are now being erected on site, and two Francis turbines, each of 3,100 h.p., for the Hora Hora Power Station on the Waikato River, these machines, operating under a 27 ft. head. This firm recently obtained the orders for the 6,000 k.v.a. generators, and the 100,000 volt. switchgear for the Mangahao Hydro Electric Power Station in New Zealand.

A contract for 12 four-wheeled coupled bogie express passenger locomotives for the Caledonian Railway has recently been awarded to the North British Locomotive Company, Limited, of Glasgow, whilst the Vulcan Foundry, Limited, of Newton-le-Willows, Lancashire, have an order for fifteen 4-8-0 metre-gauge tender engines for the Uganda Railways. All of the locomotives are to be fitted with the patent superheater invented by Mr. J. G. Robinson, the chief mechanical engineer, Great Western Railway.

Traders and representatives of Scottish Chambers of Commerce have asked that there shall be a decrease of 12½ per cent. on the present ordinary and exceptional transit rates. It was urged that Scottish traders should not be asked to accept less than what had been granted by the English railway companies. Railway companies, who had a direct monopoly, ought to help in every possible way in the attempt to improve trade. It was quite understood that, as commercial concerns, they should be run so as to give a return on the capital of their shareholders, but at present the situation was so serious that every possible endeavour should be made to meet Scottish traders in the way that the English companies had met English traders.

Mr. George F. Mason, the chairman of the Bristol Channel District of the Society of Consulting Marine Engineers and Ship Surveyors, presided at the general meeting of the members of the district held at the Park Hotel, Cardiff, on Thursday, August 17. He was supported by Mr. George Humphreys (President of the society), Mr. C. E. Smith, Hartlepool (Vice-President), Mr. Hy. Grey, London; Mr. John White Boyd, Glasgow; Mr. George Strong, Hull; Mr. C. M. Burls, Mr. Casebourne, and Mr. H. E. J. Camps, London; and the general secretary (Mr. R. K. Munroe). The chairman extended a welcome to the President and other members of the council, after which a Paper was read by Mr. E. J. Scott, associate member, of London, on "The Inflow of Water through Ballast and Bilge Pump Lines," followed by an interesting discussion.

A notice is being issued to the unsecured creditors of Fuller's United Electric Works, Limited, to the effect that consequent upon the trade depression it is necessary to take steps to reorganise the capital. The company has consulted Sir Arthur Whinney, who is engaged on a scheme which will be submitted to a meeting to be held at the earliest possible date. In 1920 the company made an issue of 200,000 7 per cent. notes in order to provide additional working capital. These notes do not mature until 1925. It is hoped that the business will be kept going until the scheme has matured, and to this end the directors are refraining from paying such sums as are due to unsecured creditors so as to prevent anyone obtaining a preference. In the meantime the business is being carried on in order to preserve the goodwill, any necessary supplies being paid for in cash.

It is understood that the London Electric Railway Company have decided to place contracts with five of the principal British railway rolling stock manufacturers for the design and building of a sample electric passenger coach of all steel construction and embodying all the latest improvements, including fire resisting and safety appliances, for experimental service on the Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, and the Charing Cross, Euston and Hampstead Tube Railways. The successful firms are the Metropolitan Carriage, Wagon, and Finance Company, Limited, of Saltley, Birmingham, the Gloucester Railway Carriage and Wagon Company, Limited, the Leeds Forge Company, Limited, the Birmingham Railway Carriage and Wagon Company, Limited, and Cammell, Laird and Company, Limited, of Nottingham.

The Industrial Court has issued its award in an arbitration between the Workers' Union and Messrs. Guest, Keen, & Nettlefolds, Limited, Dowlais, with reference to the claim of the union to reinstate a quarter of a turn per shift previously paid to their members employed at the ingot-mould foundry, Dowlais Works. The quarter turn per shift in dispute has been paid in the ingot-mould foundry for many years. Wages have been based on a nominal day rate, but the worker has, in fact, been paid this nominal rate plus one quarter, and such percentage addition as was payable under the steel-workers' sliding-scale has been calculated on this enhanced base. The Dowlais works closed down owing to lack of orders in January, 1921. When work was resumed in January, 1922, the employers, it was stated, without notification to the union, ceased to pay the extra quarter turn, and it was against their action that the union appealed. The Court decided that the quarter turn should be reinstated for a period of four weeks from the beginning of the first pay period following this decision; and that as from the termination of such four weeks there should be paid such rate as might be agreed by the parties. Should the parties be unable to agree the matter should revert to the Court, who, on the application of either party, would be prepared to receive additional evidence and give a further decision.

Company News.

Charles Clifford & Son, Limited.—Dividend, 10 per cent. on ordinary, tax free.

John Oakey & Sons, Limited.—Interim dividend 2½ per cent. on ordinary, less tax.

Fairbairn Lawson Combe Barbour, Limited.—Interim dividend of 5 per cent. on preference shares; 8 per cent. on ordinary.

Humber Graving Dock and Engineering Company, Limited.—Final dividend of 4 per cent. on ordinary, making 4 per cent. for year.

Walter Scott, Limited.—Profit, including £10,826 brought forward, £24,256; interest on 4 per cent. debenture stock, £12,000; amount carried to special reserve account, £7,531; carried forward, £2,225.

Compagnie des Minerais de Fer Magnetiques de Mokta-el-Hadid.—This concern reports that the deliveries during the first half of the current financial year have already reached 203,000 tons, as against 225,250 tons for the whole financial year 1921.

IRON AND STEEL MARKETS.

Pig-iron.

The close of the holiday month has brought little change in the general position as far as pig-iron is concerned, but it is, at all events, reassuring to note that movements on the whole are favourable to a steady expansion of business on account of home consumers as the autumn advances. This view is confirmed by conditions reported in the Midlands, where pig-iron markets presented a very firm appearance. To a large extent this may be attributable to the American coal strike, exports of fuel to that country having combined to strengthen the market for coke. Naturally, in face of such a development, pig-iron quotations were firm, though not as yet quotably higher. There were also reports of increased business, which, here and there, has enabled smelters to obtain a little accumulation of orders, though there is still nothing like good forward contracting. The interruption of the Race Week holiday on Teeside was doubtless responsible for the uiet conditions prevailing in the Cleveland iron market, but there are anticipations of increased activity this month when the autumn buying usually begins. On the export side the one bright spot is the American demand, there having been further sales last week both of hematite and foundry iron, and it is reported that there is an inquiry also for forge iron of a special quality. This trade comes at an opportune moment in view of the slackness in other directions, and conviction is strong that whether they can afford it or not Cleveland makers will have to further cut prices to get their share of prospective business. It is now possible to land Continental iron into Scotland at about 85s. per ton c.i.f., whilst No. 3 Cleveland iron costs 93s. per ton at Grangemouth. Moreover, Midland iron is offered at 80s. per ton f.o.t. at works, and is being shipped at East Coast ports well below the price of Cleveland iron. Thus Cleveland makers are being shut out of many markets, and the only remedy seems to be lower prices. No further move, however, has yet been taken in that direction, and No. 3 G.M.B., the standard quality, is not less than 87s. per ton, some makers quoting 87s 6d. The scarcity of No. 1 and silicious iron keeps the price at 95s. per ton, but No. 4 foundry iron is down to 86s., No. 4 forge 84s., and mottled and white 80s. per ton, f.o.t. or f.o.b.

In the North-East hematite markets there has been a little more iron sold for shipment to the States, and a steady trade is being done with South Wales steel makers, who find this quality the cheapest in the country, even with transport charges added. Very small parcels are being sold to Italy, and occasionally an inquiry comes to hand from Belgium. Steel makers have big stocks and would gladly realise. They cannot, however, cut prices further, and if they did so it is doubtful if the demand would much increase. Under these circumstances 89s. per ton represents about the minimum figure for mixed numbers, and some makers will not quote below 90s. per ton with No. 1 at a premium of 6d. per ton.

Some recovery in the ferro-alloy market may be noted of late, ferro-silicon in all grades, from 10 to 12 per cent. to 90 per cent., having received attention, but with 45 per cent. material mostly in request. Prices are very steady, and the previous easing-off in 45 per cent. grade appears to have been checked. Seventy-five per cent. is, however, easy in price at £21 15s. to £22 delivered, and it is possible a better figure could be secured with a firm offer for a fair-sized parcel. Twenty to 25 per cent. grade is quoted round about £9 per ton delivered c.i.f. United Kingdom port, to which another 20s. should be added to cover railway carriage, etc., to inland destinations. Ferro-manganese and spiegel are unaltered in price, and the general situation remains unchanged, with perhaps a little easing off in American demand, due to the coal dispute there and consequent restricted operations.

Finished Iron.

Indications in the principal markets for finished material are certainly favourable to a much improved tendency, and although full employment at works is by no means completely restored, the increasing volume of inquiries and new business actually transacted inspires the hope that the depression is gradually disappearing. So far, inquiries in circulation have related to comparatively small tonnages, but in the aggregate represent a fairly substantial total, affording reasonable grounds for encouragement. At Birmingham last week there was a much more optimistic tone apparent, and manufacturers generally agreed that though orders on a large scale were scarce, business on the whole was distinctly better. Marked bar makers are steadily employed, but would certainly welcome an expansion of demand for forward account, the orders now in hand representing only a moderate tonnage. Unmarked iron is practically unchanged, inquiries for nut and bolt material having fallen off lately, while in contrast the market for gas strip shows a distinct improvement, even in competition with similar products of steel, mills for the manufacture of this material having been recently restarted in Birmingham. Iron founders in the Midlands and elsewhere supplying the engineering trade with castings are reported to be disappointed at the extremely slow expansion of business in that connection, and in most departments of the industry orders are difficult to obtain. Business in the foundry trade is also adversely affected by the wholesale suspension of many building schemes, due to the withdrawal of Government support.

Steel.

Conditions in most branches of the steel industry continue quietly active, Sheffield manufacturers reporting a steadily growing demand for most of the cheaper qualities, both for home and export. Continetal makers are beginning to inquire again, but Germany, owing to exchange difficulties, appears to be no longer a factor in the competition for business. The bonus reductions recently accepted by the steel trade workers will enable British manufacturers to quote more advantageously for some of the important contracts now offering, and the effect on Sheffield industry will, it is expected, be substantial. Railway steel orders are being rather more freely placed, and tool-steel orders are being fairly well booked. The demand for semi-products is also on an improving scale, soft basic qualities being a leading feature. In this connection Lincolnshire makers are becoming somewhat keen competitors in the Sheffield market, and in consequence local makers have cut the price to £7 5s., but even so the Lincolnshire figure is not reached. Medium basic billets cost in the region of £8s 5s., and hard basic £8 10s. to £8 15s. In acid billets there is not quite so much doing, but prices hold at the old figures, viz., £10 for Siemens and £12 10s. for Bessemer. At Glasgow, steel-sheet makers remain fairly busy. The recent reductions in home prices have stimulated a fair tonnage of orders, and this, with the demand for export, has made makers' position much better all round. Export business continues to improve. The demand from the Colonies is still good, and certain other oversea markets are again becoming interested in British material.

There is little fresh to report in the condition of the tinplate market, the depreciation in the exchanges having apparently checked Continental buying for the time being. There is more inquiry coming from the Far East, but no business of any moment has yet resulted. South America has been placing a few orders, but quantities were not large. Prices of the leading lines may be quoted as follow:—Coke Tins.—IC 14 x 20, 12 sheets, 108 lbs., 19s. 3d. to 19s. 6d. per box; IC 28 x 20, 112 sheets, 216 lbs., 38s. 6d. to 39s. 3d. per box, all net, f.o.b. Wales.

Scrap.

In most markets for scrap metal some slight improvement may be reported, but progress in this direction is necessarily slow, and the majority of merchants now hold stores greatly in excess of the present competitive demand. In Yorkshire there is a better inquiry for steel scrap than for some time past, but users seem unwilling to pay the prices asked by holders, who contend, quite truly, that their quotations are low as compared with new material. It is stated that German representatives are in the market again for melting scrap. As more furnaces are put into operation, and competition for the available supplies of scrap becomes greater, there is little doubt that the expectation of holders that prices will rise will be fulfilled. Heavy steel in furnace sizes is quoted at about 67s. 6d., and heavy steel turnings of good quality at 58s. to 60s. There is only a poor demand for iron scrap. A little wrought material is being sold. Machinery scrap of good quality for foundry purposes is quoted at 75s. to 80s., but the market is very quiet.

Metals.

Copper.—The market for standard copper during the past week has developed a weaker tendency, due, in part, to nervousness arising from the political situation and the erratic disposition of foreign exchanges. There has been, further, a lack of confidence in buying on consumptive account, and an absence of the

speculative dealings which of late have been an active feature in metal markets. On the other hand, however, the partial settlement of the coal strike in America has tended to balance matters. Reports from that country state that the position is comparatively firm, with sellers disinclined to offer at below 14 cents. The statistical position in the United States has improved, stocks now being at a normal level, and it is anticipated that with a settlement of the railway strike a good demand from American consumers will be forthcoming. Current quotations:—*Cash*: Wednesday, £63 2s. 6d.; Thursday, £62 7s. 6d.; Friday, £61 12s. 6d.; Monday, £62; Tuesday, £62 10s. *Three Months*: Wednesday, £63 2s. 6d.; Thursday, £62 10s.; Friday, £61 15s.; Monday, £62 5s.; Tuesday, £62 15s.

Tin.—Reports of a partial settlement of the American coal strike imparted a somewhat stronger tone to the market for standard tin last week, but otherwise the position is practically unchanged. The close of the holiday month, however, will, it is anticipated, bring a revival of more active conditions, advices received from the States suggesting a small resumption of buying in that quarter, while some improvement may also be expected in the Welsh tinplate demand, in view of the autumn canning season. At one time the East showed considerable reserve, and did not make any appreciable sales, but recently a fair amount of business was done out there. Taking a general view of the market, a note of caution seems necessary, as in view of the large "option" account which exists, price movements in the near future may be influenced less by actual developments in the situation than by artificial factors and the mood of operators. Current quotations:—*Cash*: Wednesday, £160; Thursday, £158 15s.; Friday, £157 10s.; Monday, £158 7s. 6d.; Tuesday, £159 10s. *Three Months*: Wednesday, £160 2s. 6d.; Thursday, £158 17s. 6d.; Friday, 157 12s. 6d.; Monday, £158 10s.; Tuesday, £159 15s.

Spelter.—Messrs. Rudolf Wolff & Company, in their weekly report, state:—Much of the recent decline has been recovered. More interest has been taken in forward delivery, for which a good speculative demand has arisen. The near position, though comparatively neglected, is still well controlled, and the backwardation has been fairly constant at about £1. The position otherwise remains about the same; markets in the U.S.A. and on the Continent are firm, and producers maintain the same independent attitude. Remelted spelter is not being offered so freely, and the price has advanced, while hard spelter is quiet, but stocks are strongly held, and full prices are asked. Current quotations:—*Ordinary*: Wednesday, £31 10s.; Thursday, £31; Friday, £30 7s. 6d.; Monday, £30 15s.; Tuesday, £31.

Lead.—The market for soft foreign pig was subject to slight fluctuations in values during the past week, but with little material change in the general conditions. The consumptive demand has recently seen some improvement, and sales have been fairly well absorbed, although rather heavier deliveries have caused a certain amount of liquidation. Current quotations:—*Soft foreign* (prompt). Wednesday, £24 17s. 6d.; Thursday, £24 10s.; Friday, £23 15s.; Monday, £24; Tuesday, £24 7s. 6d.

Personal.

THE LATE Mr. Frederick John Gardner, of Durleston Lodge, St. Agnes Road, Moseley, Birmingham, manufacturer, left £21,483.

THE LATE Mr. Martin Henry Watts, of Oxford Road, Macclesfield, of the Catherine Street Foundry, Macclesfield, left £5,496.

THE late Mr. John Nathaniel Harrison, of Chatham Street, Liverpool, engineer, a member of the firm of Hosking & Callan, left £1,944.

THE LATE Mr. Nicholas Trestrail, of Claremont Road, Redruth, Cornwall, of the firm of N. Trestrail & Son, engineers, Redruth, left £5,780.

THE LATE Mr. Norman Joseph Lockyer, of Darlington, manager of the North-Eastern Railway Company's locomotive works at Darlington, left £5,806.

MR. HOWELL JONES, general manager of the Dowlais undertakings of Messrs. Guest, Keen & Nettlefolds, Limited, has been made a Justice of the Peace for Merthyr.

THE LATE Mr. Richard Wilder, of Erleigh Grange, Erleigh Road, Reading, senior partner of John Wilder, of the Yield Hall Foundry, Reading, and of R. J. & H. Wilder, implement makers, Wallingford, left £18,014.

MR. W. J. HOLLOWAY, who has entered upon his retirement after 42 years' service at the Bute Docks, entertained his clerical staff, past and present, of the Great Western Railway (Cardiff Railway section) at dinner at the Queen's Hotel, Cardiff, on August 19.

Deaths.

SIR JOHN BRYN EDWARDS, BART., died at his residence, Hendrefoilan, Swansea, on Tuesday, August 22. Sir John, who was the first baronet, had been in failing health for a couple of years, but his illness only took a serious turn on Friday last. Sir John Bryn Edwards was the eldest son of the late Mr. W. H. Edwards, J.P., proprietor of the Duffryn Steel and Tinplate Works, Morriston, and grandson of the late Mr. Daniel Edwards, their founder. Sir John's father developed these works and made a success of them, and he did a good deal of public work at Swansea, where he was a member of the council for many years, became an alderman, and passed the mayoral chair in 1894. Sir John's mother was a daughter of the late Mr. William Williams, J.P., of Maestygwernen, owner of the Upper Forest and Worcester Steel and Tinplate Works, Morriston, and sister of the late Mr. T. Jeremiah Williams, M.P., of Maesygwernen, so that he was intimately connected with the chief industries of the district by descent on both sides. Sir John received a classical and technical education, and graduated M.A. at Cambridge. His younger brother lost his life in the war, and he himself soon after commencing his business career became a victim to incipient pulmonary disease, which afterwards prevented the development of his prospects in the business life of South Wales. He was, however, of an active and sanguine nature, and, endeavouring to follow in the footsteps of his father, he entered public life as a member of the Swansea Council in 1918, and would have been due to retire after his first term of office next November. He showed a great interest in the technical business of the corporation, but his activities were circumscribed by his failing health. The early death of his father left him in possession and control of the Duffryn Works, and these he soon afterwards disposed of to the company which now carries them on.

THE partnership heretofore subsisting between Arthur Main and Charles William Frederick Temple, carrying on business as engineers and contractors, at Adelphi Chambers, Shakespeare Street, Newcastle-on-Tyne, under the style or firm of Main & Company and Main & Temple, has been dissolved.

Wires: "COMPETE, NOTTINGHAM."

MOULDING SAND
CORE SAND
FACING SAND
FIRE SAND
GRAVEL
HIGH SILICA SAND
PARTING SAND

Let us know your requirements.
Satisfaction! Lowest prices!

The STANDARD Company,
136-138, Mansfield Road,
NOTTINGHAM.

Telephone: 21, Penistone. Telegrams: "Durranns, Penistone."

ESTABLISHED 1863.

JAS. DURRANS & SONS., LTD.

Phoenix Works, Penistone NEAR SHEFFIELD.

BLACKING
PLUMBAGO
CORE GUM
WHITE DUST
COAL DUST

Manufacturers of

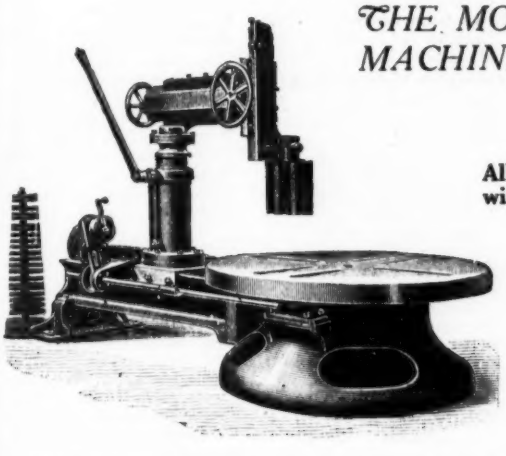
FOUNDRY EQUIPMENTS.

Ladles, Cupolas, Fire Bricks, Ganister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, Etc.

Write for illustrated catalogue on Blacking and Foundry Requisites, also for our latest Price List.

WHITTAKER'S IMPROVED MOULDING MACHINE

By which Wheels or Pulleys of any description or size from 3 inches to upwards of 20 feet diameter can be made.



THE MOST COMPLETE & EFFICIENT MACHINE HITHERTO INTRODUCED TO ENGINEERS.

All Machines warranted to Mould with the greatest accuracy and precision.

GEARING WHEELS

Spur or Bevel, Straight Teeth and Double Helical Teeth Supplied to Consumers.

ROPE & BELT PULLEYS.

WILLIAM WHITTAKER & SONS, Ltd.

SUN IRON WORKS - - - OLDHAM.

WEEKLY PRICE CURRENT.

COPPER.

	£	s	d.
Standard cash	62	10	0
Three months	62	15	0
Electrolytic	68	15	0
Tough	65	5	0
Best selected	65	5	0
Sheets	94	0	0
India	84	0	0
Wire bars	69	10	0
Do. Sept.	69	10	0
Do. Oct.	69	10	0
Ingot bars	69	10	0
H.C. wire rods	75	0	0
Off. aver. cash, July 63	3	7	3/4
Do. 3 mths., July 63	10	5	1/4
Do. Settlement July 63	3	2	1/2
Do. Electro, July 71	0	0	
Do. B.S., July 67	0	0	
Aver. spot price, copper, July 63	2	6	
Do. Electro, July 71	13	7	
Solid drawn tubes		13 1/2	d.
Brazed tubes		13 1/2	d.
Wire		10 1/2	d.
Yellow metal rods		6 1/2	d.
Do. 4x4 Squares		8 1/2	d.
Do. 4x3 Sheets		9 1/2	d

BRASS.

Solid drawn tubes	11 1/2 d.
Brazed tubes	13 1/2 d
Rods, drawn	10 1/2 d.
Rods, extruded or rolled	6 1/2 d.
Sheets to 10 w.g.	10d.
Wire	9 1/2 d.
Rolled metal	9 1/2 d.

TIN.

	£	s	d
Standard cash	159	10	0
Three Months	159	15	0
English	159	0	0
Bars	161	0	0
Chinese	158	0	0
Straits	160	0	0
Australian	160	0	0
Eastern	160	5	0
Banca	159	12	6
Off. aver., cash, July	156	4	4 1/2
Do. 3 mths., July	156	14	5 1/2
Do. Stilment. July	156	4	2
Aver. spot, July	156	3	7

SPELTER.

	£	s	d
Ordinary	31	0	0
Remelted	29	10	0
Hard	23	0	0
Electro 99.9	35	5	0
English	31	2	6
India	23	10	0
Prime Western	31	0	0
Zinc dust	48	0	0
Zinc ashes	9	0	0
Off. aver., July	28	18	5 1/4
Aver., spot, July	29	0	10 1/2

LEAD.

	£	s	d
Soft foreign ppt	24	7	6
English	25	10	0
Off. average, July	24	6	11 1/2
Average spot, July	24	17	4 1/2

ZINC SHEETS.

	£	s	d
Zinc sheets, English 37	0	0	
Do. V.M. ex. whf. 37	10	0	
Dutch	37	0	0
Rods	42	0	0
Boiler plates	35	0	0
Battery plates	35	10	0

ANTIMONY.

	£	s	d
English regulus	25	15	0
Special brands	32	10	0
Chinese	23	10	0
Crude	15	0	0

QUICKSILVER.

Quicksilver 12 10 0 to 12 15 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s	d
Ferro-silicon—			
45/50%	12	5	0
75%	21	10	0
Ferro-vanadium— 35/40%	17/6 lb. va.		
Ferro-molybdenum— 70/75%	6/6 lb. mo.		
Ferro-titanium— 23/25%, carbonless	1/1 lb.		
Ferro-phosphorus, 20/23%,	£20		
Ferro-tungsten— 80/85%, carbon free	1/5 lb.		
Tungsten metal powder— 98/99%	1/9 1/2 lb.		
Ferro-chrome—			
4/6% car.	£23	10	
6/8% car.	£23		
8/10% car.	£22	10	
Ferro-chrome—			
Max. 2% car.	£60		
Max. 1% car.	£70		
Max. 0.70% car.	£78		
67/70%, carbonless	1/7 lb.		
Nickel—99%, cubes or pellets	£150		
Cobalt metal—98/99%	10/6 lb.		
Aluminium—98/99%	£100		
Metallic Chromium— 96/98%	5/- lb		
Ferro-manganese(net)—			
76/80%, loose	£15		
76/80%, packed	£16		
76/80%, export	£14	10	
Metallic manganese— 94/96%, carbonless	2/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. to 8 in. inclusive	4d. lb.
Rounds and squares under 1/4 in. to 1/2 in.	3d. lb.
Flats under 1 in. by 1/8 in. to 1/4 in. by 1/2 in., and all sizes over four times in width over thickness	3d. lb.
Bevels of approved sizes and sections	6d. lb.
If in coils	3d. lb.
Packing	£3 ton.
Bars cut to length	10% extra

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.
South Wales—			
Heavy Steel	3	7	6
Bundled steel & shearings	2	17	6
Mixed iron & steel	2	17	6
Heavy cast iron	3	5	0
Good machinery for foundries	4	0	0
Cleveland—			
Heavy steel	3	2	6
Steel turnings	2	5	0
Cast-iron borings	2	5	0
Heavy forge	3	12	6
Bushelled scrap	3	2	6
Cast-iron scrap	3	12	6
Lancashire—			
Cast iron scrap	4	0	0
Heavy wrought	3	10	0
Steel turnings	2	2	6
London—			
Copper (clean)	57	0	0
Brass (clean)	31	0	0
Lead (less usual draft)	20	0	0
Tea lead	18	0	0
Zinc	17	0	0
New aluminium cuttings	60	0	0
Braziery copper	47	0	0
Gun metal	41	0	0
Hollow pewter	125	0	0
Shaped black pewter	80	0	0

Above are merchant's buying prices delivered yard.

PIG-IRON.

N. E. Coast—	
Foundry No. 1	95/-
Foundry No. 3	87/-
Forge No. 4	84/-
Mottled	80/-
Hematite No. 1	90/6
Hematite M/Nos.	90/-
Midlands—	
Staffs. common	—
„ part-mine forge	—
„ „ foundry	—
„ Cold blast	240/-
„ basic	—
Northants forge	70/- to 72/6
„ foundry No. 3	77/6 „ 80/-
„ basic	82/6
Derbyshire forge	75/-
„ foundry No. 3	82/6
„ basic	80/-
Scotland—	
Foundry No. 1	100/-
„ No. 3	95/-
Hematite M/Nos.	107/6
Sheffield (d/d district)—	
Derby forge	82/6
„ foundry No. 3	86/6
„ basic	—
Lincs. forge	86/6
„ foundry No. 3	86/6
„ basic	86/6
E.C. hematite	101/-
W.C. hematite	105/-

All d/d in the district.

Lancashire (d/d eq. Man.)	—
Derby forge	—
„ foundry No. 3	92/6
Northants foundry No. 3	—
Cleveland foundry No. 3	—
Staffs. foundry No. 3	—
Lincs. forge	—
„ foundry No. 3	—
Summerlee foundry	112/-
Glengarnock foundry	114/6
Gartsherrie foundry	114/6
Monkland foundry	112/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.
Bars (cr.)	£10 10 to 11	10	0
Angles	£11 to 11	10	0
Tees to 3 united ins.	£11 10 to 12	0	0
Nut and bolt	9	17	6
Hoops	14	0	0
Marked bars (Staffs.)	13	10	0
Gas strip	11	2	6
Bolts and nuts, 1/4 in. × 4 in.	19	10	0
Steel—			
Ship plates	9	10	0
Boiler plates	12	10	0
Chequer plates	10	10	0
Angles	8	15	0
Tees	9	12	6
Channels	8	10	0
Joists	9	0	0
Rounds & squares 3-in. to 5 1/2 in.	10	0	0
Rounds, under 3in. to 1/2 in.	9	10	0
Flats, over 5in. wide and up	10	0	0
Flats 5in. to 1 1/2 in.	8	10	0
Rails, heavy	8	15	0
Fishplates	14	10	0
Hoops	11	10	0
Black sheets, 24 g.	12	0	0
Galv. cor. sheets, 24 g.	16	10	0
Galv. fencing wire, 8 g. plain	16	0	0
Rivets, 1/2 in. dia	14	0	0
Billets, soft	7 2 6 to 7	5	0
Billets, hard	8	0	0
Sheet bars	7 0 0 to 7	7	6

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 3
Sheet	1 3 1/2
Wire	1 3 1/2
Rods	1 2 1/2
Tubes	1 6
Castings	1 1

Delivery 3 cwt. free to any town.

10% phosphor copper, £40 above price of B.S.

15% phosphor copper, £50 above price of B.S.

Phosphor tin (5%), £30 above price of English ingots.

Charles Clifford & Son Limited, Birmingham.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	11d. to 1/5
Rolled—	
To 9 in. wide	1/5 to 1/11
To 12 in. wide	1/5 1/2 to 1/11 1/2
To 15 in. wide	1/6 to 2/0
To 18 in. wide	1/6 1/2 to 2/0 1/2
To 21 in. wide	1/7 1/2 to 2/1 1/2
To 25 in. wide	1/8 1/2 to 2/2 1/2
Ingots for spoons and forks	11d. to 1/5
Ingots rolled to spoon size	1/2 to 1/8

Wire round—

3/0 to 10. G. 1/8 1/2 to 2/3 1/2 with extras according to gauge

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	33.14
No. 2 foundry Valley	30.00
No. 2 foundry, Birm.	19.50
Basic	27.96
Bessemer	28.76
Malleable	29.96
Grey forge	30.00
Ferro-manganese 80 % delivered	70.82
Bess. rails, h'y, at mill	40.00
O.-h. rails, h'y, at mill	40.00
Bess. billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	35.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.32
Steel bars	1.90
Tank plates	1.90
Beams, etc.	1.90
Skelp, grooved steel	2.00
Skelp, sheared steel	2.00
Steel hoops	2.50
Sheets, black, No. 28	3.15
Sheets, galv., No. 28	4.15
Sheets, blue an'l'd, 9&10	2.40
Wire nails	2.40
Plain wire	2.25
Barbed wire, galv.	3.05
Tinplate, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	35/-
„ furnace	30/-
Durham & North. foundry	28/-
„ furnace	23/6
Other Districts, foundry	27/6
„ furnace	22/6

SWEDISH IRON.

Bars, hammered basis sizes Basis price £22 to £23

	£ s. d.
Rolled Ordinary— Assortment ..	17 0 0
Nail Rods— Square, round and flats ..	to 17 10 0

Keg Steel nom. £38 to £40
Faggot Steel nom. £30 to £32

Blooms—
Single welded .. £10 to £11

Billets—
Single and double welded £13 to £14

Pig-Iron—
Grey, white or mottled .. £8 to £8 15 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

	Up to and incl. 6 in.	
Gas ..	55%	Tube prices are now free.
Water ..	50%	
Steam ..	45%	

TINPLATES.

I.C.Cokes,	20×14, box	19/3
,,	28×20, ,,	38/9
,,	20×10, ,,	27/9
,,	18¾×14, ,,	19/7½
I.X.	,	45/6
I.X.X.	,,	52/-
F.C.B.Y.	21×13⅝ ,,	37/-
C.V.B.G.	16¾×15, ,,	35/6
I.C.W.	20×14, ,,	17/-
,,	28×20, ,,	33/9
,,	20×10, ,,	23/3
,,	18¾×14, ,,	17/3
Terneplates,	28×20, ,,	35/-

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
Aug. 23	63	2	6	dec.	7/6
,, 24	62	7	6	,,	15/-
,, 25	61	12	6	,,	15/-
,, 28	62	0	0	inc.	7/6
,, 29	62	10	0	,,	10/-

Electrolytic Copper.

Aug. 23	69	5	0	dec.	10/-
,, 24	69	0	0	,,	5/-
,, 25	68	0	0	,,	20/-
,, 28	68	10	0	inc.	10/-
,, 29	68	15	0	,,	5/-

Standard Tin (cash).

Aug. 23	160	0	0	dec.	5/-
,, 24	158	15	0	,,	25/-
,, 25	157	10	0	,,	25/-
,, 28	158	7	6	inc.	17/6
,, 29	159	10	0	,,	22/6

Tin (English ingots)

Aug. 23	159	10	0	dec.	5/-
,, 24	158	5	0	dec.	25/-
,, 25	157	5	0	,,	20/-
,, 28	158	0	0	inc.	15/-
,, 29	159	0	0	,,	20/-

Zinc Sheets (English).

Aug. 23	37	10	0	No change	
,, 24	37	10	0	,,	
,, 25	37	0	0	dec.	10/-
,, 28	37	0	0	No change	
,, 29	37	0	0	,,	

Spelter (ordinary).

Aug. 23	31	10	0	inc.	5/-
,, 24	31	0	0	dec.	10/-
,, 25	30	7	6	,,	12/6
,, 28	30	15	0	inc.	7/6
,, 29	31	0	0	,,	5/-

Lead (English).

Aug. 23	26	0	0	No change	
,, 24	25	10	0	dec.	10/-
,, 25	25	0	0	,,	10/-
,, 28	25	0	0	No change	
,, 29	25	10	0	inc.	10/-

THE
ARMITAGE WORKS Co., Ltd.
Manufacturers of
Highly Refractory Bricks and Blocks
FOR ALL PURPOSES.

SPECIALITIES:
CUPOLA LININGS.
Ladle Bricks for Siemens Ladles.
Chequer Bricks, etc., for Siemens Furnaces.
Gas Producer Linings.

GROUND GANISTER
for Iron, Steel, and Brass Furnaces. Forced Draught Brass Furnaces. Semi-Silica or Semi-Ganister Bricks. Silica Cement.

DEEPCAR, Near Sheffield.

SHROPSHIRE IRON Co., Ltd.

Works:—
Hadley, Shropshire.

London: 10, Bush Lane, Cannon St., E.C.4.

Telegrams:—
Sun, Wellington, Salop.
Sunbrand (Cannon), London.

Telephone:—
11 Wellington, Salop.
5959 Central.

BARS, HOOPS, SECTIONS & WIRE
in IRON, STEEL, COPPER and BRONZE.
Galvanised Telegraph, Telephone, Cable and Trolley Wire
To all Specifications.

Contractors to H.M. Government (Admiralty, G.P.O., India Office, War Office, Colonies), English and Foreign Railways, &c.

BEST H. C. COPPER & BRONZE WIRE a speciality.

Medals:—Sydney (Bronze) 1879, New Zealand (Gold) 1882, Liverpool (Silver) 1886, Adelaide (Gold) 1887, Franco-British Grand Prix (Highest Award) 1908.

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT
5, MURZBAN ROAD, BOMBAY.
1, LALL BAZAR CALCUTTA.

REGISTERED TRADE MARK

1, HONG KONG ROAD, SHANGHAI.
31, RAFFLES PLACE, SINGAPORE.
JAVA STREET, KUALA LUMPUR.
5 SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.

PIG IRON
SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.
FOUNDRY COKE
COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,
ROYAL EXCHANGE, MIDDLESBROUGH.
93, HOPE STREET, GLASGOW.

SITUATIONS VACANT AND WANTED.

MOULDER REQUIRES STEADY AND PROGRESSIVE JOB. Accustomed to complete control. Motor and General Engineer and Jobbing. Personally operating Cupola and other Furnaces, making oil-sand jacket cores, and supplying castings to analysis. Iron, Aluminium and Bronze. Good Technical and Practical: Mathematics, Mechanics, Chemistry, Physics, Metallurgy, Iron and Steel Manager and Mechanical Drawing. Good knowledge of costs, and could assist in Drawing Office, Pattern Shop or any department of Foundry. I.B.F. and B.C.I.R.A. Man. — Apply: F. A., c/o Ignition Laboratory, 57, Union Street, Oldham, Lancs.

ADVERTISER, Age 39, seeks position as Non-ferrous FOUNDRY MANAGER. Twenty-five years' practical experience. Thorough knowledge of up-to-date plant and practice. Unimpeachable references. Address, in first instance, Box 212, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

AUCTION SALE.

By direction of the Right Hon. the Viscount Hood.

NORTHAMPTONSHIRE.

Within 2 miles of Kettering (M.R. main line); 7 miles from Wellingborough; Cranford Station (M.R.) and Butlins Sidings adjoining.

THE IMPORTANT FREEHOLD AGRICULTURAL AND MINERAL PROPERTY

known as

"THE BARTON SEAGRAVE ESTATE,"

lying within a ring fence, in the Parish of Barton Seagrave, near to the town of Kettering, bounded by good hard roads, intersected at the south-east corner by the Midland Railway, and containing an area of about

854 ACRES, with the

VALUABLE BEDS of IRONSTONE lying thereunder.

To be Offered for Sale by Auction as a whole, or in 2 lots (if not previously disposed of by private treaty), by

BERRY BROS. & BAGSHAW,

at the George Hotel, Kettering, on Friday, September 8th, 1922, at 4 o'clock in the afternoon precisely.

Particulars, with Plans, may be obtained of the Solicitors, Messrs. Broughton, Holt & Middlemist, 12, Great Marlborough Street, London, W.1.

Land Agents: Messrs. Fisher & Co., Market Harborough.

Auctioneers: Messrs. Berry Bros. & Bagshaw, Kettering.

MACHINERY.

WANTED, a Second-hand Adaptable Stripping Machine, medium size. State where same can be viewed, and price.—Apply, Box 242, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED, Drop Moulding Machine to take boxes 24 in. square, for hand power. Also quantity of Boxes suitable for same.—THE NORTHERN PRESS ENGINEERING COMPANY, LIMITED, South Shields.

FOR SALE.

Two new Thompson Dish-ended Lancashire Boilers, 30 ft. x 8 ft. 3 in., for 150 lbs. pressure. Three Lancashire Boilers, 30 ft. x 7 ft. 6 in., now insured at 150 lbs. pressure. Two Cornish Boilers, 28 ft. x 6 ft. diameter, reinsure 90 lbs. pressure. Four Marine Water Tube Boilers, by Yarrow, Limited, each 4,000 sq. ft. heating surface, reinsure 200 lbs. pressure. One Loco Type Boiler, barrel 7 ft. 6 in. long x 3 ft. diameter, reinsure 80 lbs. pressure. One Vertical Boiler, 6 ft. 6 in. x 3 ft. 9 in. diameter, reinsure 80 lbs. pressure. One Hornsby Waste Heat Water Tube Boiler, about 40 h.p., reinsure 160 lbs. pressure. Air Receivers, 6 ft. x 2 ft. 6 in., tested to 90 lbs. pressure, with safety valve, drain cock, etc.

Catalogue of Stock Machinery, 5-6,000 Lots. Free on Application. Inspection Invited.

THOS. W. WARD, LTD.,
ALBION WORKS,
SHEFFIELD.

ONE 20-in. CENTRIFUGAL FOUNDRY SAND MIXER, capacity 1 to 2 tons per hour, fitted with latest improvements and equal to new.—Price and particulars on application to C. E. V. HALL, 26, Paradise Square, Sheffield.

MACHINERY —*Contd.*

NEW WELDING PLANT, with Acetylene Generator, six blowpipes, etc., ready for use, £17 5s.; complete new Cutting Plant, £15 10s. Lists free.—STANSELL'S ACETYLENE COMPANY, LIMITED, Exeter.

FOUNDRY SAND MIXERS (three), never been used, for 1, 2 and 4 tons per hour; clearance prices.—Box 158, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

CUPOLAS! CUPOLAS!! CUPOLAS!!!—Fifteen Riveted Steel Cylinders, as new, 18 ft. x 2 ft. 6 in.; would make excellent Cupolas, complete with Steel Girder Framework Pipes and Air Ducts; £300 the lot, f.o.r. Details, Drawings.—HARRY H. GARDAM & COMPANY, LIMITED, Staines.

MISCELLANEOUS.

PENCIL GANISTER, of high quality, and other grades for Sale.—Apply, R. E. ADAMSON, Ushaw Moor, County Durham.

S. G. SMITH,

Iron Foundry Expert,

Late Foundry Specialist with Metropolitan Vickers Electrical Company, Limited, Trafford Park, Manchester,

Is again available for consultations, investigations, and advice on all matters appertaining to Iron Foundries and Castings.

Upwards of 40 years' active experience of work of all classes.

Author of Articles covering Modern Foundry Practice, including

Foundry Lay-out and Design,
Cast-iron. Analysis and Mixings for Various Castings,
Cupola Practice and Management,
Moulding and Facing Sands. Blackings, etc.,
Loam and Sand Procedures, etc., etc.,

Lecturer and Teacher on Foundry Processes at the College of Technology, Manchester.

Practical Tuition to Foundry Students, private, or in classes; also Universities, Colleges, and Technical Schools.

Consultations, away or at home, by appointment.

Terms, reasonable and satisfactory.

CUPOLAS

30-in. ALLDAY'S CUPOLA with hoist, staging, 20ft. by 10ft. and roof, complete installation £150 f.o.r., standing in London.

42-in. WHITING CUPOLA, with spark arrester, staging, hoist, etc., ready for immediate use, and complete in every detail, £380 f.o.r. London, for the entire plant, including 3 phase, 50 cycle, 415 volt electric hoist, and electric blower, same voltage.

URGENTLY REQUIRED

2-ton stock oil-fired converter. Two small tilting cupolettes. Also **all kinds** of surplus foundry plant **for re-sale.** Please send offers to—

ALEXANDER HAMMOND,
Foundry Machinery Merchant,
"BOXTED," SLOUGH.

SCRAP ALL YOUR CRUCIBLES

See Displayed Advertisement last week.

For Prices and particulars apply to :—

BRITISH REVERBERATORY FURNACES LTD.
82, Victoria Street London, S.W.1.

Branch Office: Winchester House, Victoria Square, Birmingham. **Telephone: Victoria 6971.**